make:able
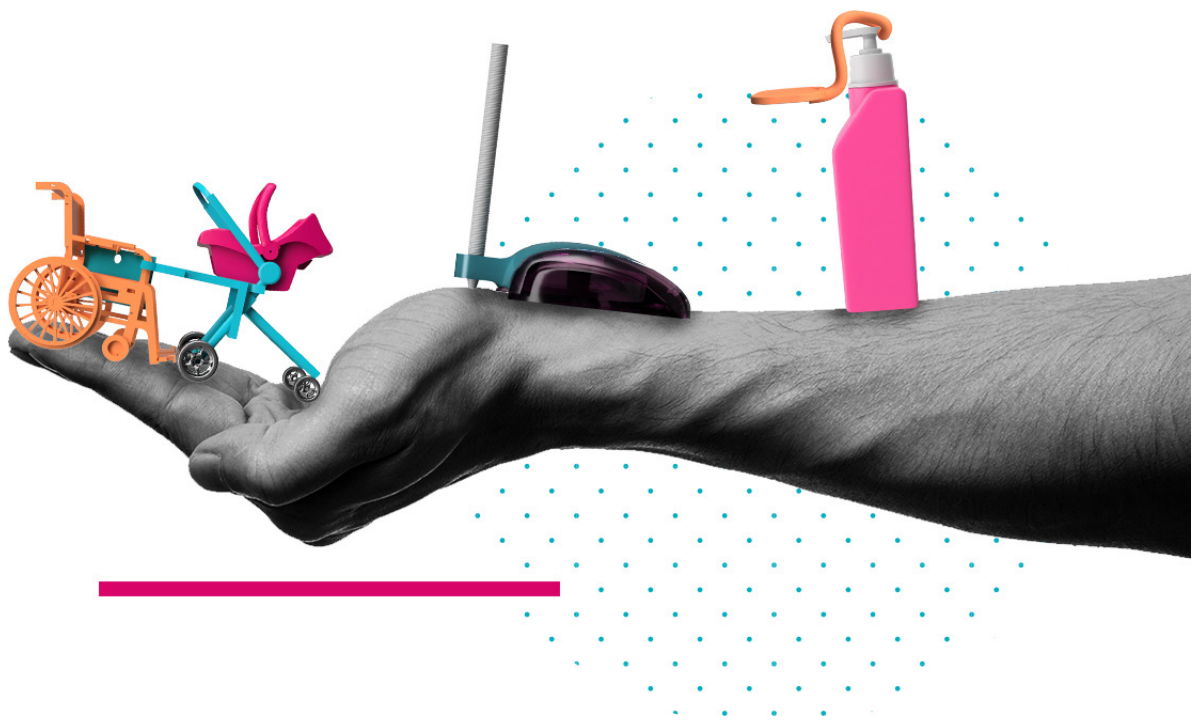
Teacher's Guide

An assistive technology design challenge for students, brought to you by PrintLab, Autodesk and Partners

PrintLab. **AUTODESK**

empathise

with humans and their day-to-day challenges

learn

how to use design-thinking to solve problems

design

solutions driven by digital technologies

make

products that are enhanced by modern manufacturing

Contents

Introduction

Get a comprehensive overview of the
make:able challenge

Make:able Overview

Have a think about the day-to-day tasks people perform with their hands. We brush our teeth, we drink from cups, we write, we hold utensils, we use computers, we unlock doors, we open parcels and more. But for people with certain disabilities or the elderly, these tasks can be difficult, painful or even impossible. With the technology, skills and creative mindsets of the present, we can make a difference...

we can make anything.

Introducing make:able - a free assistive technology design challenge for students of all ages, where they will work in teams to make a 3D printable product that improves the day-to-day life of someone with a disability or the elderly. Going beyond a competition, make:able centres around an online challenge toolkit, which takes students through a step-by-step process to design and make a life-changing assistive device. From explainer and case study videos to 3D design tutorials and design-thinking templates, students will be equipped with all the training and resources to become creative and technical problem solvers with empathy for the world around us.

Accompanied by a comprehensive range of professional development and teaching material, the make:able challenge is suitable for any teacher/instructor looking to deliver a meaningful, human-centred design project. It can be run in a variety of formats including:

- design and technology, computing, engineering and STEM lessons
- lunchtime/afterschool clubs
- distance/home learning strategies
- out-of-school workshops

The Brief

Start Date: 16th May 2024 | Submission Deadline: 15th May 2025

Design and make a 3D printed product or prototype that improves the day-to-day life of someone with a disability or the elderly.

Categories

There are 3 categories based on age groups – under 14, 14-18 and over 18. The over 18 age category welcomes students, educators, hobbyists, professionals and anyone else interested in participating.

Teams

You may work in teams of up to 5 people in the same age category.

Audience

You must design a product for a real end user (E.g. Someone in your local community). If you cannot find an end user, you can opt to design for a Make:able Champion. Make:able Champions are people with disabilities who have shared their story and day-to-day challenges within the Make:able Challenge toolkit.

3D Design

The design process must include the use of either Tinkercad or Fusion 360 software and the digital 3D model produced should be 3D printable.

3D Printing

A physical 3D printed prototype must be created. 3D printing can also be combined with other materials and processes, such as electronics, to create the product.

Submissions

You must create a 2-4 minute video, which shows information about your end user, how you developed empathy, how you framed a challenge, the idea generation process, the design-make-iterate process and visuals of the final product in action. Videos must be uploaded to the online form included in section 8 of the toolkit by the 15th May 2025. In addition to the video, you will be required to provide the following information during your online form submission:

- High resolution final image
- 3D design files (Tinkercad or Fusion 360)
- Bill of materials and assembly/usage instructions (if any)
- License (type of permission granted to others who wish to use their designs)

Full guidance on submissions is provided in section 8 of the online toolkit.

Design Criteria + Award Categories

You should aim to adhere to the below design criteria throughout your make:able journey.

🔷 **Empathy**

Develop a deep and personal understanding of your end user's disability, challenges and needs/wants.

🔺 **Creative Idea**

Use design-thinking methods to realise a product idea that differentiates itself from existing solutions in the market.

🔴 **Autodesk Software**

Explore multiple tools and features in Autodesk software to help drive your design.

🟧 **Customisation**

Make a solution that is a perfect fit for your end user in terms of form and function.

★ **3D Printing**

Make full use of 3D printing's capabilities to generate forms with creative freedom.

🔵 **Iteration**

Rigorously test and refine a solution to ensure it is optimal for your end user.

There will be a total of 6 awards for each age group (under 14, 14-18, over 18). The award categories are as follows:

- Best Showcase of Empathy
- Best Creative Idea
- Best Use of Autodesk Software
- Best Showcase of Customisation
- Best Use of 3D Printing
- Best Showcase of Iterative Design

The judging process is outlined in the next section and as you can see, the award categories directly relate to the design criteria. This means that for the best chance of winning an award, you should aim to excel in all design criteria.

Judging Process

15th May 2025 - 31st May 2025: Team PrintLab will review all submissions and create a finalist shortlist of approximately 6 entries per award category in each of the 3 age groups. The finalist shortlist will be announced by email and consist of the entries that excelled the most in the design criteria relating to the award category.

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1st June 2025 - 30th June 2025: An expert panel of judges from the medical, education and design fields will be invited to review the finalist submissions. Each judge will be allocated a specific award category and will cast votes for a 1st and 2nd place. 1st place will receive 2 points and 2nd place will receive 1 point. An online voting platform will be used where judges can view submissions, cast votes and make comments.

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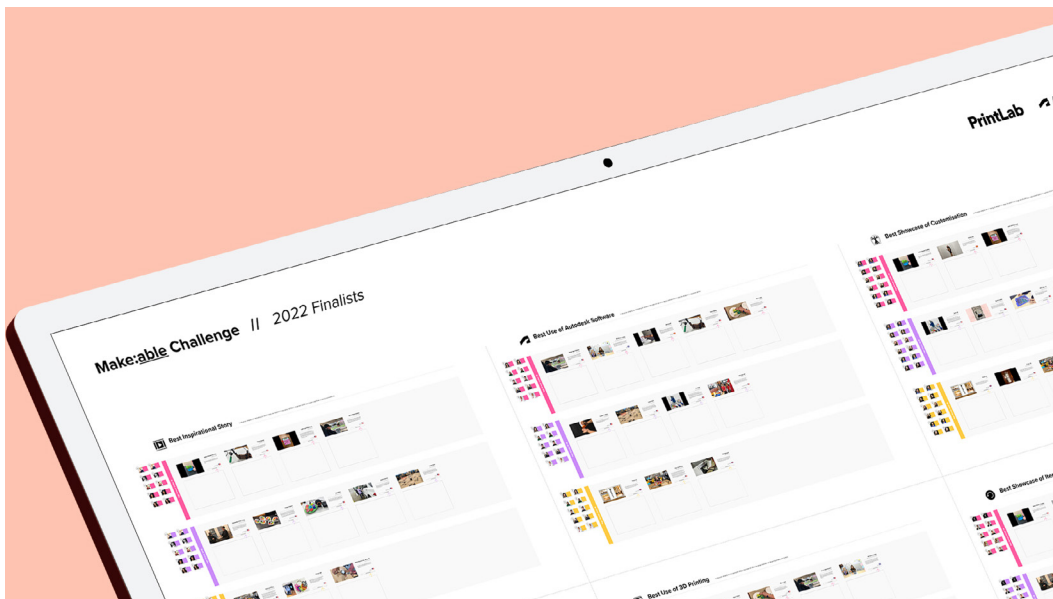
1st July 2025: The points from each award category and age group will be counted and the 18 winners will be announced via email. Prizes will then be shipped out to the schools/ organisations of the winning teams. Prizes are yet to be determined but will consist of a range of 3D printers, 3D scanners, filament and more. All participants will also receive certificates following the judging period.

Please note that all announcements will be sent to the email address you used to sign up to Make:able.

The Challenge Toolkit + Workbook

The online challenge toolkit is a complete set of resources that supports students throughout their make:able journey. To access the toolkit, students simply need to head to makeablechallenge.com/toolkit and sign in using the access code provided to you after registration.

Accompanying it is a workbook (available in both the teacher's pack and downloadable from the toolkit) designed to assist students in planning their strategy for each stage and capturing key insights, helping them to stay organised and focused throughout the process. The workbook is an interactive PDF, which can be filled in digitally using Adobe Acrobat Reader (free), or Acrobat Pro. Text and checkbox fields can be filled in with other PDF readers but Adobe Acrobat must be used if they'd like to upload images too. Alternatively, they can print it out to write in and attach images manually.

As students move through the online toolkit, they'll be prompted to fill in sections of the workbook as they go. Please note that the toolkit and workbook are optional resources. You are free to follow your own design process as long as you meet the requirements of the brief.
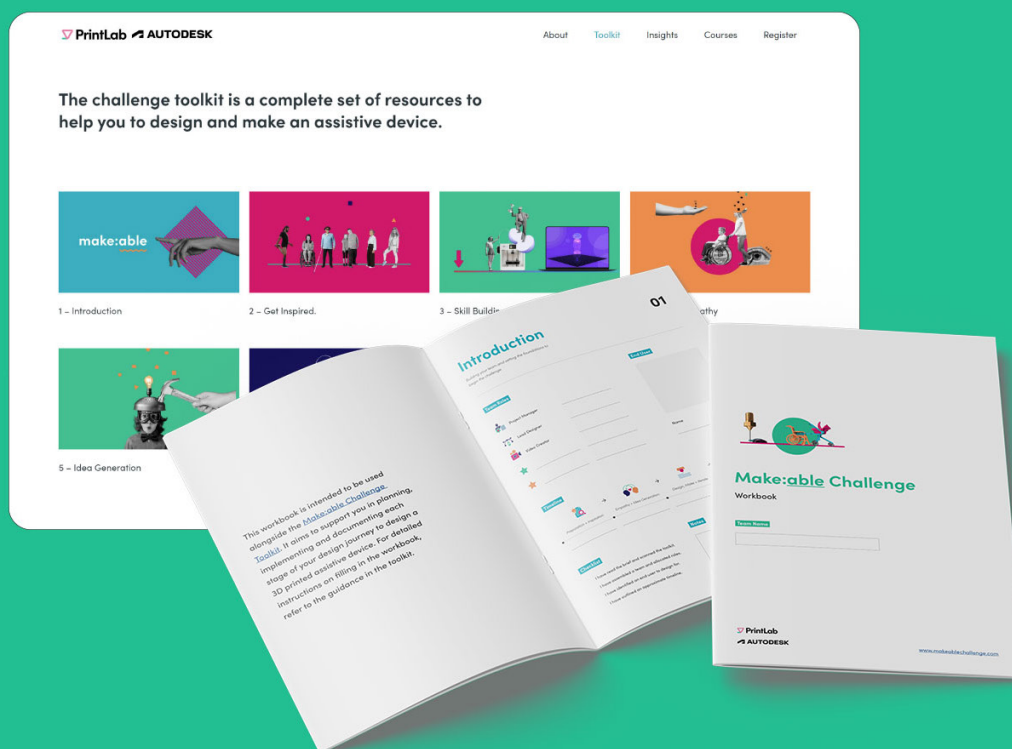
The teacher's pack also includes a set of standards-aligned lesson plans, which shows you how the toolkit and workbook can be used within the classroom across 12 sessions. We'll take a look at the lesson plans later but first of all, the following pages will show you the typical journey students will take, together with the toolkit resources available to them.
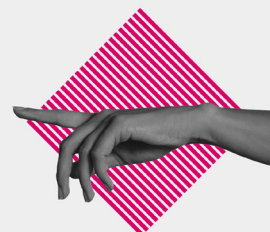
The Student Journey

1 – Introduction

Students are introduced to the challenge, brief, toolkit and workbook, before being advised to assemble their team and identify an end user.

Challenge Toolkit Resources:
Welcome video, brief, toolkit and workbook instructions, local end user options, make:able champion introductions, general tips

2 – Get Inspired

Students are provided with context of the opportunities with 3D printing and assistive technology. Industry interviews and example submissions are shown to provide inspiration.

Challenge Toolkit Resources:
Inspiration video, assistive technology organisation interviews, example submissions
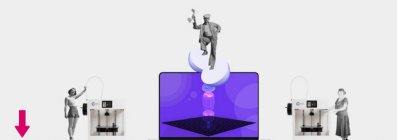
3 – Skill Building

Students participate in a range of video tutorials to design example devices. The technical skills learnt will enable students to bring their own unique ideas to life later on.

Challenge Toolkit Resources:
Skill building video, software selection, PrintLab 3D CAD and 3D printing learning platform trial
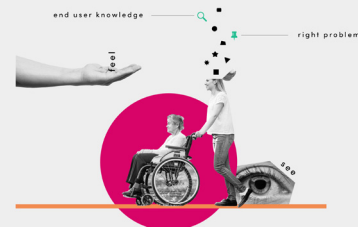
4 - Develop Empathy

Students are provided with guidance and a range of activities and resources to truly understand the difficulties their end user faces with day-to-day activities.

Challenge Toolkit Resources:
Empathy video, empathy methods, empathy tips, empathy gallery, challenge framing instructions

5 - Idea Generation

Students learn how to turn their empathy studies into creative ideas by using a range of design thinking methods.

Challenge Toolkit Resources:
Idea generation video, idea generation methods, idea generation tips, idea generation gallery, criteria instructions
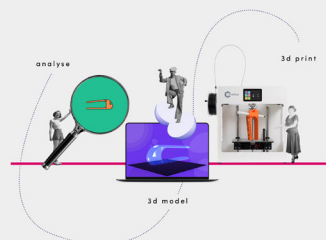
6 - Prototype

Students are provided with expert advice and resources to help them to design and make their first 3D printed prototype.

Challenge Toolkit Resources:
Design and make video, design and make methods, prototyping tips, prototyping gallery
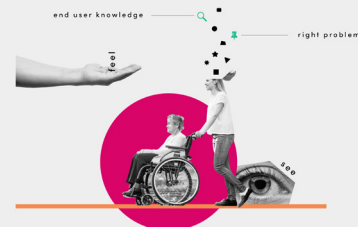
7 – Test + Iterate

Students are provided with guidance and a range of activities to go through the cycle of testing and refining their prototype to reach their final solution.

Challenge Toolkit Resources:
Test and iterate video, iterate methods, iterate tips, iterate gallery

8 – Share your Story

With final products/prototypes created, students are given advice on how to tell their story in video format. Finally, they submit their solutions and videos via an online form.
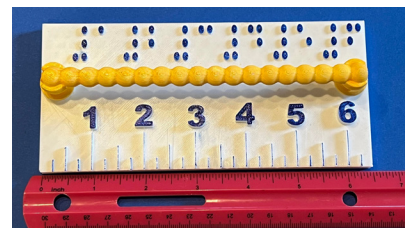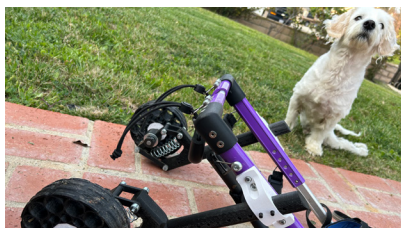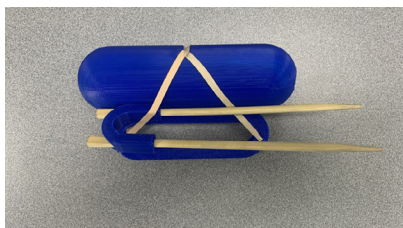
Challenge Toolkit Resources:
Share your story video, example structure, video editing tips, submission preparation, submission form

Example Solutions

Here is a snapshot of various solutions from previous challenges.

Preparation

get you and your students ready for the
make:able challenge

Equipment List

Here is a list of recommend equipment to participate in make:able.

Computers

Computers/laptops can be shared if 1:1 devices aren't an option in your team.

Wifi

Make:able's challenge toolkit is hosted on a website, which can be accessed from any place and time as long as you have an internet connection.

Camera

The key to a good submission is documenting the entire journey with a camera. Don't worry about obtaining an expensive piece of kit – smartphone cameras are more than capable of shooting good quality video.

3D Printers + Filament

Our recommended brands are Prusa Research for 3D printers and Filamentive for materials. If you do not have 3D printers available, we recommend contacting local organisations/ makerspaces, who may be able to support you with 3D printing services.

Large Format Paper + Sticky Notes

Large format paper (A2+) and sticky notes are amazing tools that can help teams to collaboratively solve problems, generate ideas and analyse outcomes. The challenge toolkit has several design thinking activities, which encourage the use of these materials. Therefore it is recommended that they are sourced.

Modelling Materials/Clay

Modelling clay and readily available materials (e.g. cardboard) can help you to quickly generate basic ideas before going in to detailed designs. It can be especially powerful to mould clay around objects or hands to drive the ergonomic form of a design.

Software

Select either Tinkercad or Fusion 360 software and ensure your accounts are created prior to the make:able challenge. Both packages are free for education and developed by Autodesk.

Tinkercad

Tinkercad is a free, browser-based 3D design, electronics and coding app made by Autodesk. When using Tinkercad's 3D design workspace, you begin with what's essentially this construction kit of shapes. Think of these shapes as digital lego that you can place and adjust, before combining them with other shapes. It's the perfect entry point for people getting started with 3D design, yet it's got the versatility and complexity to design almost anything you can imagine. We recommend Tinkercad for students in the under 14 category and it has a range of classroom management tools to support you. Learn more and get started at:

https://www.tinkercad.com/

Fusion 360

Fusion 360 is a cloud-based, full product design platform used amongst innovative and creative industries. It's comprehensive set of tools enable you to design with precision, render realistic images, simulate loads, animate joints and much more.
The amazing thing about Fusion 360 is that it's intuitive and user-friendly enough for anyone to get to grips with - and it's completely free for education. We recommend Fusion 360 for the 14+ age groups and you can learn more and get started at:

https://www.autodesk.com/education/free-software/featured

Preliminary Activities

Going in to the make:able challenge with basic knowledge and skills in 3D design and 3D printing will be highly beneficial. To support your make:able journey, we recommend taking a look at PrintLab.

PrintLab is our very own online platform of 3D printing courses and projects, which can help students to build new technical and creative problem-solving skills in preparation for their Make:able journey. Although PrintLab is a paid-subscription, we invite you to use the free trial to explore and share a range of relevant resources with students over a 7 day period. This can be done either prior to the challenge, or during the skill building phase. And at the end of the trial, you can choose whether you'd like to subscribe to PrintLab.

Check out some recommend PrintLab resources for Make:able participants on the next page and get started with the trial here: https://weareprintlab.com/plans/.
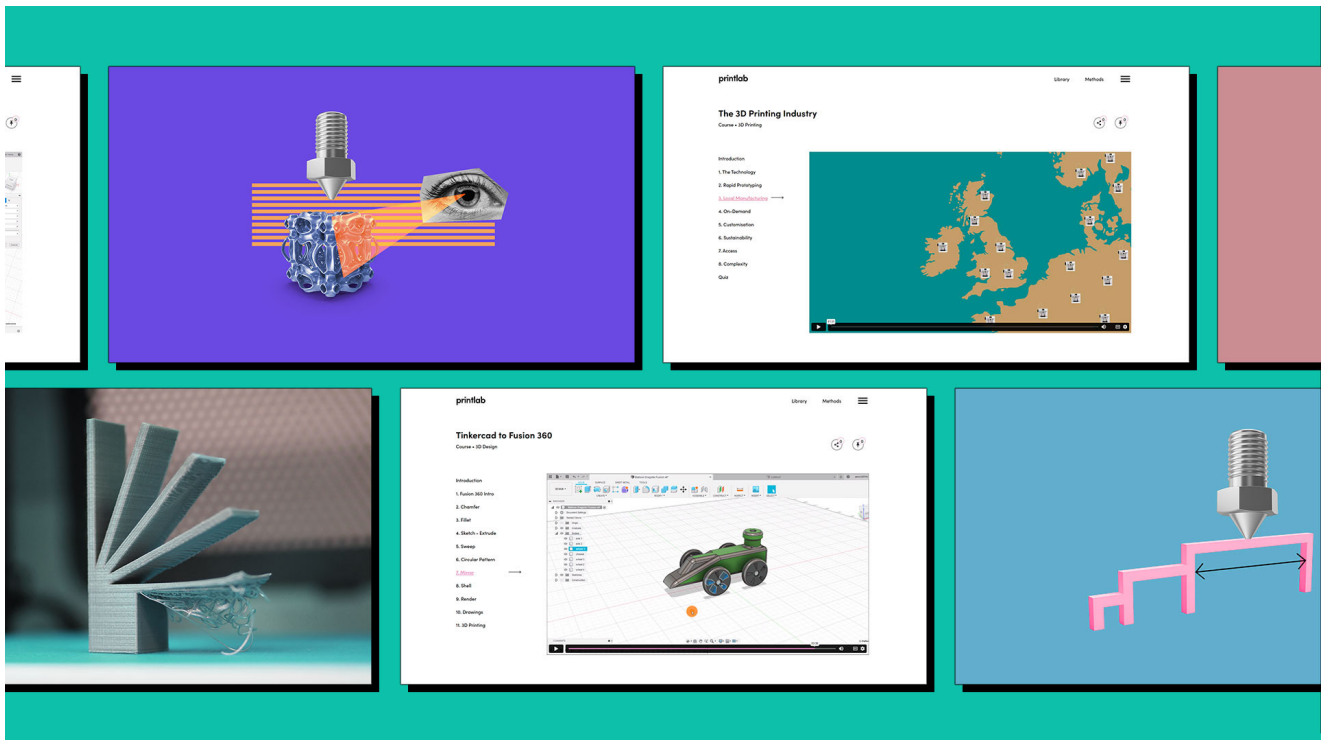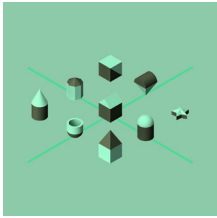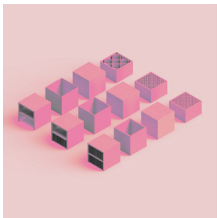
Intro to Tinkercad

This mini course combines all the key fundamentals of 3D modelling in Tinkercad into a 1–2 hour session.

Intro to Fusion 360

Learn how to get started with Fusion 360. A series of base models are provided with the course, which are used in conjunction with 13 bitesize instructional videos.

Slicing for 3D Printing

In this short online course, you will learn about 10 essential slicer settings to help get the most out of your 3D printer. The course is video based and based on FFF (Fused Filament Fabrication) 3D printers.
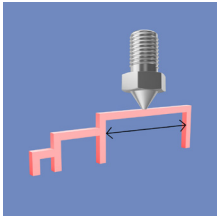
Designing for 3D Printing

In this short online course, you will learn about the best practices for designing specifically for 3D printing. The course is video based and goes over 10 essential tips to achieving good quality prints.
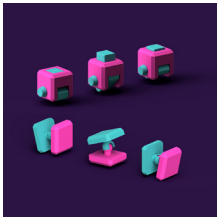
3D CAD Tutorial Library

Looking for quick tutorials rather than full projects? PrintLab's 3D CAD Tutorial library is the ultimate toolkit of Tinkercad and Fusion 360 tutorials and includes a whole section dedicated to assistive devices.
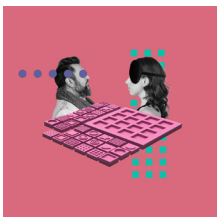
Mechanisms

In this intermediate–advanced mini course, you'll be introduced to the fascinating world of 3D printed mechanisms. The creative learning resources will teach you how to add connections and movement to your 3D models – unlocking new and innovative design possibilities.
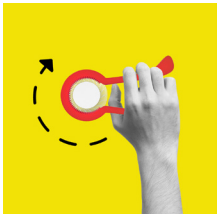
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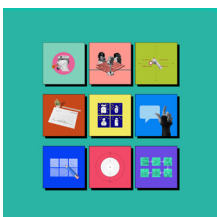
Design Methods

3D CAD and 3D printing is just a small part of the full process designers go through. In this resource, you'll explore a complete library of research, design, evaluation and presentation activities.

Learn more and start a free trial at www.weareprintlab.com

Participation

Delivering the make:able challenge in
your school/organisation

Lesson Plans

A series of standards-aligned lesson plans/guides are available to support the delivery of the make:able challenge across 12 x 1 hour sessions. All resources can be accessed from the 'Lesson Plans' folder within the teacher's pack.

The curriculum and associated resources are suitable for use with all students between the ages of 8-18, as each lesson comes with guidance on adapting activities for younger/beginner students, older/advanced students. Please note that lesson plans are for guidance only and we encourage teachers to add, omit or adapt content to their needs.

Curriculum Alignment

The make:able challenge has been developed to support curriculum requirements across the globe. Please see the associated documents in the 'Assessment and Curriculum Alignment' folder within the teacher's pack.

Curriculum Alignment/Assessment Documents

The following resources are available to support assessment and curriculum alignment:

- Curriculum Standards | ISTE / NGSS
- Curriculum Standards | UK National Curriculum
- Curriculum Standards | Australian Curriculum
- Design Thinking Assessment Rubric

Please note that curriculum documents should be used as guidance only and specific standards met will be dependent upon your chosen activities.
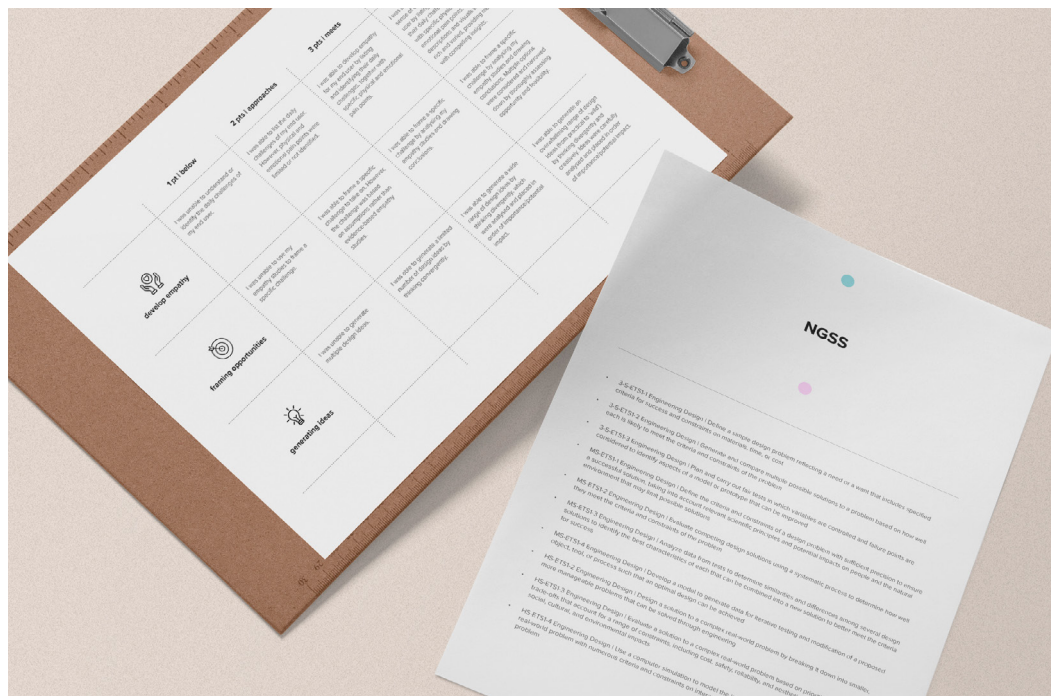
Submission Process

Once your students have completed the challenge and developed their submission videos, follow the below steps.

● **1. Check Submissions**

Using the guidance in the 'Share your Story' section of the online toolkit, check each team's files against the submission preparation checklist.

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■ **2. Consent Forms**

If students and end users have included images/videos showing their faces (or any personally identifiable information) in their submissions, please make sure to get the necessary consent forms (within the teacher's pack) filled in. These can either be uploaded with team submissions in the online form, or sent to hello@weareprintlab.com, together with their team name.

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● **3. Upload Submissions**

Once checked, guide students in uploading their videos to an online destination that can be shared. This might be a YouTube/Vimeo channel or the video file can be saved to a cloud storage site such as Google Drive or Dropbox. The video link can then be shared via the online submission form in section 8 of the challenge toolkit, together with a final image, their design files and details about their solution. An important part of the form involves students entering their teacher's email address. Ensure this is done correctly and that only first names of team members are listed.

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▲ **4. Email PrintLab**

Once all students have uploaded their submissions, send an email to hello@weareprintlab.com with the team names of submitted entries. PrintLab will then check videos have been submitted correctly, before providing you with confirmation.

Action Plan

● **Register** Ensure you have registered your school at makeablechallenge.com/register.

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■ **Plan** Gain a thorough understanding of all resources in the teacher's pack and challenge toolkit, before planning your strategy. Pay particular attention to planning both preliminary activities as well as the lesson plans.

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● **Prepare** Run any preliminary skill-building activities such as the lessons outlined earlier from PrintLab. Additionally, ensure you obtain all necessary equipment for the make:able challenge.

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▲ **Implement** Deliver the make:able challenge to students, using the available resources as guidance. Remember to customise any lesson plans/ guides to the needs of your own class. Make sure all videos are submitted before 15th May 2025.

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⬢ **Celebrate** Winners will be announced in July 2025 via email (to the address you registered with) and also via social media (@weareprintlab). At this point, we'll also be sharing a whole range of inspirational content from the challenge that everyone can enjoy and celebrate together.

Frequently Asked Questions

Who is the challenge for?

The challenge is for anyone with an interest in 3D design, 3D printing and assistive technology. There are 3 categories based on age groups – under 14, 14–18 and over 18. If students in a class are divided between an age group category, we can accept their entries into a single category of your choice.

Does it cost anything?

Absolutely not, make:able and all associated resources are completely free. We may however recommend supplementary content that may support you, such as PrintLab's 3D printing learning platform.

How much time do I need to allocate?

Our approach is to be flexible on how much time you spend on your submission. However, we recommend that a minimum of 6 x ≈ 1 hour sessions are allocated to the make:able challenge.

Do I have to follow make:able lesson plans?

Not at all. The lesson plans and challenge toolkit can be used as little or as much as you like. As long as the brief and guidelines are adhered to, feel free to create your own pathway for students.

Do beginners stand a chance in winning?

Yes! The prize categories are broad and offer anyone the chance to win. For example, a beginner in 3D design is just as likely to win the 'Best Showcase of Empathy' category as anyone else.

What are the prizes?

Prizes are under consideration but will be announced via email and social media (@weareprintlab) throughout the competition. We can however say that they will include 3D printers and other education technology products for the schools of the winning teams.

What student data do you capture?

Students access the challenge toolkit via an access code and no personally identifiable information is captured. When submitting videos, students enter their first names only and any images/videos of students will only be published online with parental consent.

What if I don't have a 3D printer?

If you do not have 3D printers available, we recommend contacting local organisations/ makerspaces, who may be able to support you with 3D printing services.

Can my students actually impact someone's life?

100%! We've been working with schools who use 3D printing to make assistive technology for several years and the outcomes have been amazing. Keep an eye out on the make:able blog as we'll be sharing inspirational examples on a regular basis.

Do I need any 3D printing experience?

Experience in 3D design and 3D printing is not required. If you go through the preliminary activities stated in this teacher's guide, you and your students will gain all the necessary skills to take on the make:able challenge.

Support

Whether you're preparing for the make:able challenge or half-way through and want to check if you're on track, we encourage you to get in touch and make use of our support system. We're always happy to provide advice and you can get in touch by emailing:

hello@weareprintlab.com

We'll also be posting regular updates and advice on our social media channels so make sure to follow us at:

@weareprintlab

**let's inspire the next generation,
<u>together.</u>**

www.makeablechallenge.com