

make:able

Lesson Plans - 12 x 1 Hour Sessions

An example set of lesson plans that support teachers in running the Make:able challenge in the classroom



Overview

Before proceeding, ensure you have read the Make:able teacher's guide and gained an overview of the online challenge toolkit at makeablechallenge.com/toolkit.

This lesson plan series guides you in delivering the Make:able challenge over a period of 12 x \approx 1 hr sessions in the following settings:

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

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 and older/advanced students. The project is aligned to the UK National Curriculum, NGSS, the Australian Curriculum and addresses the ISTE Standards for Students. Please see the accompanying documents in the 'Curriculum Alignment' folder for further information.

Please note that lesson plans are for guidance only and we encourage teachers to add, omit or adapt content to their needs.





Lesson 1

Getting prepared and inspired



Objectives

- I have read the brief and scanned the toolkit.
- I have assembled a team and allocated roles.
- I have identified an end user to design for.
- I can explain the benefits of using 3D printing for assistive technology.
- I have reviewed several case studies and made notes on things I enjoyed.

Challenge Introduction (30 mins)

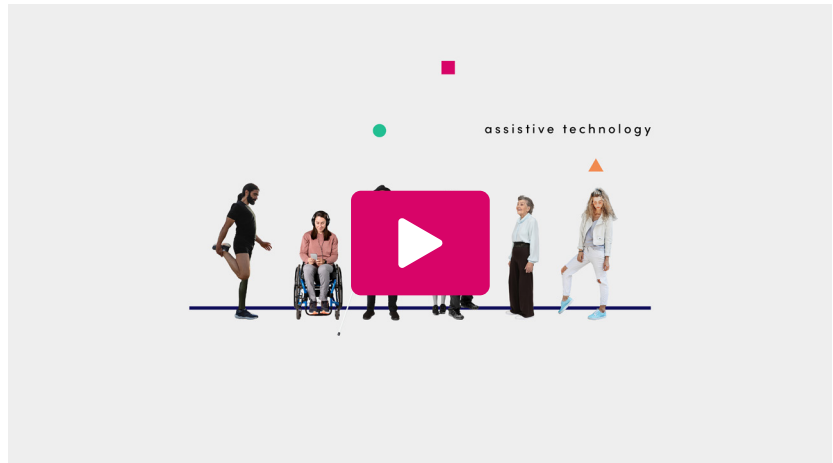
- Begin the lesson by giving students a brief overview of the challenge, toolkit and workbook. Then play the intro video from the Welcome section of the Introduction Toolkit on a large format screen. Inform students of the approximate timeline they'll have to work on each phase.
- Request that students assemble into team of 3-5 and login to the challenge toolkit. Allow them around 25 minutes to go through the sections 'How to Use the Toolkit', 'Assemble Team', and 'Identify an End User'. During this time, teams should also download the interactive workbook and begin filling in the sections as they go.

** Depending on your preferences, you may wish to request that each student completes their own workbook.*



Getting inspired overview (5 mins)

- Play the 'Toolkit Overview' video in the Get Inspired Toolkit on a large format screen. This will provide students with key information about 3D printing and assistive technology. Explain to students that the 2nd half of this lesson is all about gaining insights and inspiration.



Inspiration + insights (25 mins)

- Within their teams, ask students to navigate to the Get Inspired Toolkit and browse through a selection of interviews and example submissions. Inform them that they have 30 minutes to do this so they should select videos that might be relevant to their end user. Again, remind them to fill in their workbook as they go, as instructed in the online toolkit.



Homework

- As a homework task, request that teams look through Section 3 of the workbook and select the circles that best represents their team's skill level in that category. The scale ranges from beginner to expert, with five levels to choose from. Once completed, ask students to email you their workbooks at this stage.
- Students should also get any necessary media consent forms signed by their parents (if they are under 16), and their end user.

Ideas for adapting the lesson

- For younger/beginner students, you may wish to select the end user, and have each team design something for them. If opting for this strategy, you can also pre-select relevant videos to watch prior to the lesson. During the lesson, you can watch the content together.

Lesson 2

Building new technical skills in
3D design and 3D printing

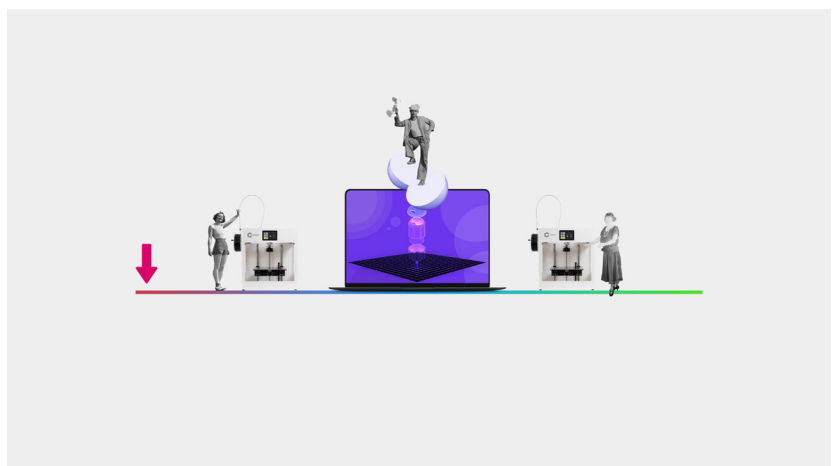


Objectives

- I have selected a 3D design software to use.
- I have developed the necessary skills to design and make an assistive device for a real end user.

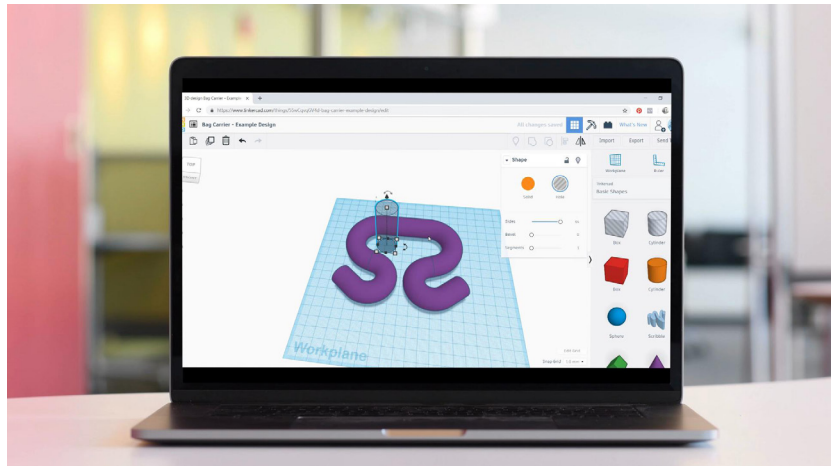
Skill building overview (5 mins)

- Play the 'Toolkit Overview' video in the Skill Building Toolkit, which will give students an overview of the impact of new technologies in the world. Explain to students that this lesson is all about learning new and modern technical skills that can be applied to their own unique assistive devices further into the project.
- Ask the class if they can outline the process of going from a digital 3D model to a 3D printed product. Informally discuss the process as a class and include information about how slicing software works.



3D design tutorials (55 mins)

- Prior to the lesson, sign up to the free 7 day trial of PrintLab and select relevant skill-building resources for your students to participate in for the remainder of the lesson. The resources you select might be based on the answers your students gave in Section 3 of their workbooks. For example, if students listed beginner level for 'Basic 3D CAD', you might select an Intro to 3D Design course for them to participate in.



Homework

- As a homework task, select another relevant PrintLab resource for students to participate in. For example, the short video series about 'Designing for 3D Printing' is a great option to provide students with tips they can use later in the project to ensure their 3D designs can be 3D printed without any issues.

** Depending on your preferences, you may wish to spend additional lessons on skill-building and guide students through one of the assistive technology projects.*

Ideas for adapting the lesson

- For younger/beginner students: During the tutorial stage, participate in tutorials as a class. Play and pause as necessary to ensure students complete each step successfully.
- For older/advanced students: Older/advanced students may have all the necessary skills in place to design an assistive device. Therefore they could skip this phase.



Lesson 3

Developing a deep sense of empathy for the end user

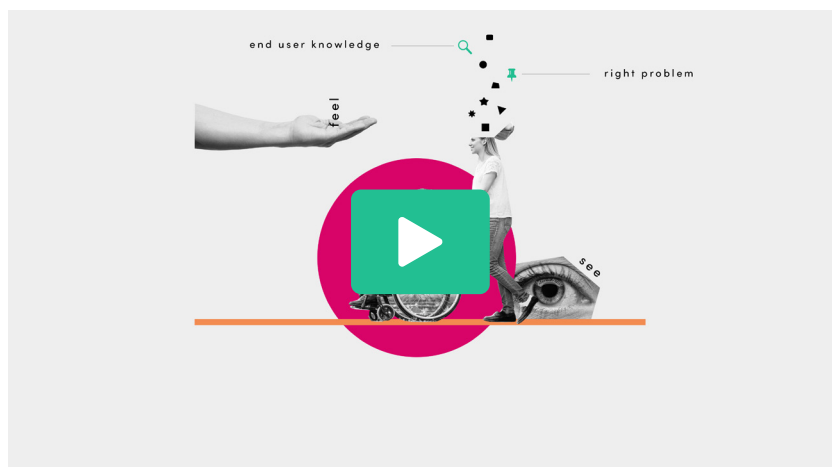


Objectives

- I planned and implemented a human-centred design strategy to develop empathy for an end user.

Develop empathy overview (5 mins)

- Play the 'Toolkit Overview' video in the Develop Empathy Toolkit, which will give students an overview of what empathy is and why it is important. Explain to students that this lesson is all about planning and implementing an empathy strategy to learn as much as possible about their end user's challenges.
- Ask the class to share how they would define empathy. Highlight the point that 'the aim is to gather a vast range of insights that allow you to pinpoint the right problem to solve, as well as equip you with the knowledge to design an assistive device that truly captures the needs and wants of your end user'.



Empathy strategy (45 mins)

- For the next 45 minutes, request that teams go through the Methods, Tips, and Gallery sections of the Develop Empathy Toolkit. During this time, students will develop a step-by-step plan to develop empathy for their end user. This might involve a user interview and a challenge map that highlights the end user's daily challenges. In this case, they should be planning when and where to meet their end user, what questions to ask and how they will record/document the process. Remind students to use the interactive workbook to plan their strategies.



Strategy critique (10 mins)

- Ask teams to pair up with another team. They should take turns to explain their empathy strategy, whilst the other team respectfully critiques them. The critiquing team should be trying to find holes in their strategy, as well as suggesting alternative or new ways of doing things. For example, Team 1's strategy might be to only interview an end user who is blind. In this case, Team 2 may suggest that it might also be helpful to observe their end user performing various activities. The aim of the critique is to get additional opinions that might help teams to improve their strategy plans.

Homework

- As a homework task, students should implement their empathy strategies. Remind them to document everything (video recordings, images, notes etc.) and to insert a summary of their experience, as well as 4 key insights in their workbook.



Ideas for adapting the lesson

- For younger/beginner students that might struggle in developing their own empathy strategies, you may wish to pre-plan a strategy for them. For example, you could insist and guide them in performing a user interview and creating an empathy map.
- For those designing for a Make:able Champion, students should think creatively about how they can develop empathy using methods such as simulating their disability, carefully observing the champion's case study video, performing online research and speaking with others who have a similar disability.



Lesson 4

Framing the challenge and
generating design ideas



Objectives

- I analysed and used data to frame design opportunities and initial criteria.
- I used divergent thinking to generate a broad range of design ideas.
- I used convergent thinking to narrow design ideas down to a single key idea.
- I determined necessary design criteria and features based on my end user's needs and wants.

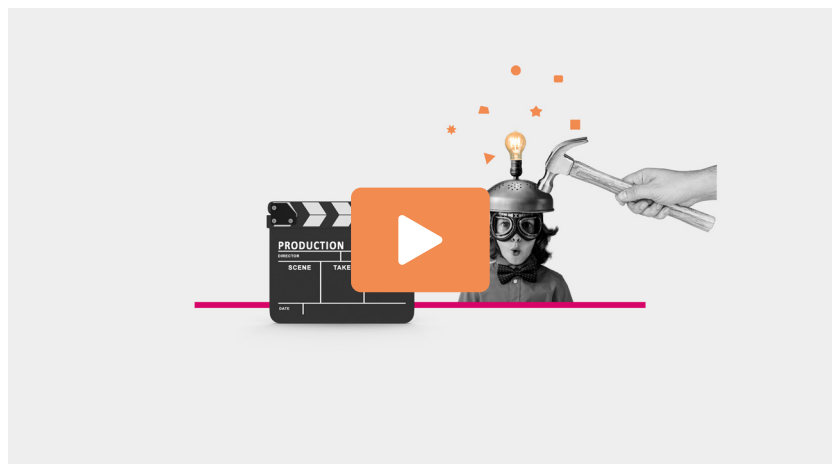
Framing the challenge (10 mins)

- Ask students to bring out their completed empathy studies (video clips, notes etc) and to go through the 'Frame the Challenge' section of the Develop Empathy Toolkit. During this time, they will explore How Might We questions, before selecting one and generating a list of initial design criteria. Remind students that the goal is not to determine a specific product to make, but rather to determine an open-ended challenge to solve.



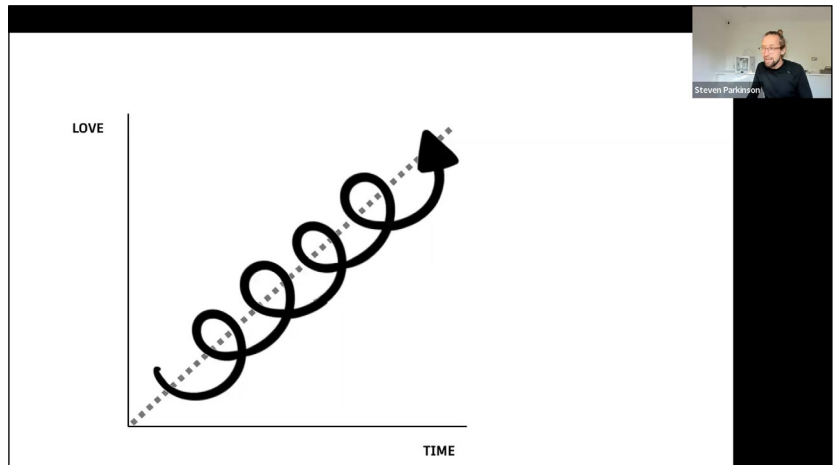
Idea generation overview (5 mins)

- Play the 'Intro' video in the Idea Generation Toolkit, which will provide students with advice on generating initial design ideas. Explain to students that this lesson is all about thinking divergently and coming up with as many ideas as possible, before narrowing them down to a key idea to take forward.



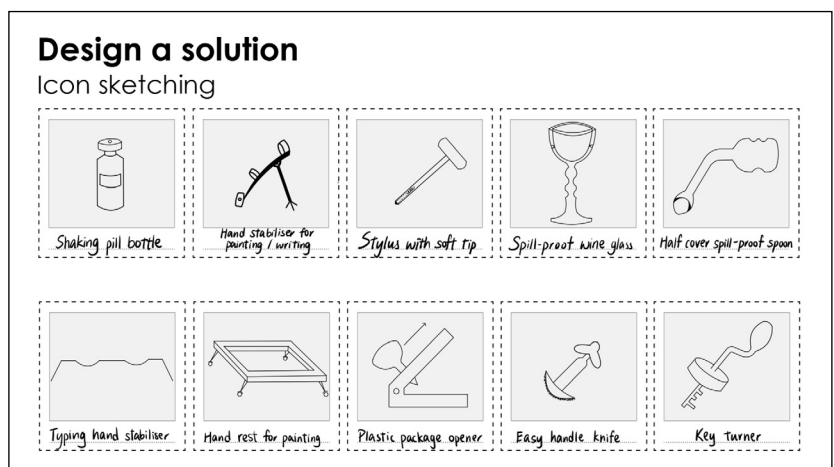
Idea generation strategy (15 mins)

- Similarly to the empathy stage, teams should now go through the Methods, Tips, and Gallery section of the Idea Generation Toolkit to plan out their strategies.



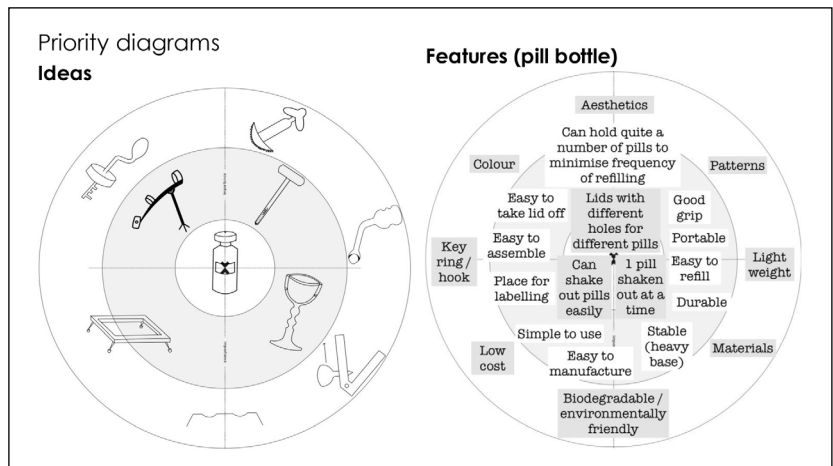
Generating ideas (30 mins)

- Allow teams 30 minutes to generate a broad range of ideas using the methods they chose. This might involve using the icon sketching method, group brainstorming method, or another method not listed in the toolkit. Remind students that the goal is to generate a lot of very basic ideas with zero focus on aesthetics, forms or details. And then to analyse them and select a key idea to take forward. Images of the idea generation process should be inserted into the workbook, together with a summary of ideas and a description of the key idea.



Homework

- As a homework task, students should go through the Design Criteria section of the Idea Generation Toolkit. In this activity, they will add more criteria to their initial list, before mapping their criteria out in order of importance. This can all be done in the priority diagram template within the workbook.



Ideas for adapting the lesson

- For younger/beginner students that might struggle in developing their idea generation strategies, you may wish to pre-plan a strategy for them. An easy set of methods would be to use icon sketching followed by dot voting.
- Encourage older/advanced students to really focus on innovation by ensuring ideas are completely different or improved to existing solutions in the market. They should also be aiming for 20+ different ideas.



Lessons 5-6

Concept development and 3D printing an initial prototype

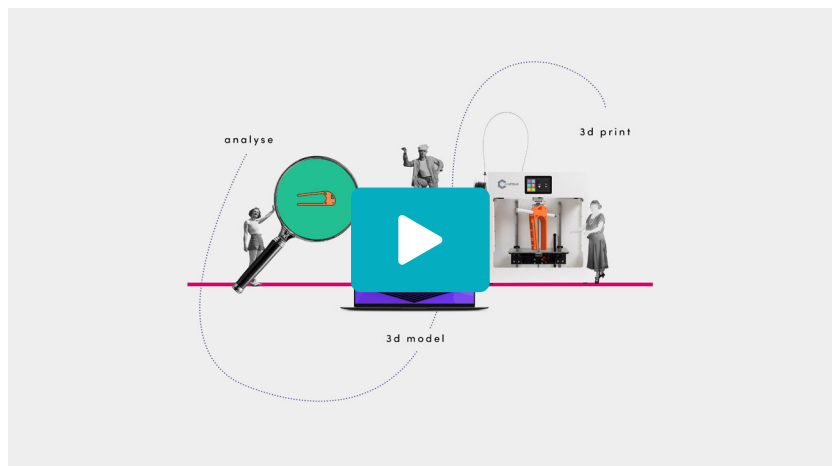


Objectives

- I developed visual concepts and low-fidelity prototypes driven by a set of design criteria.
- I developed a 3D printable digital model of an assistive device, based on my chosen concept.
- I used 3D printing technology to manufacture an assistive device prototype.

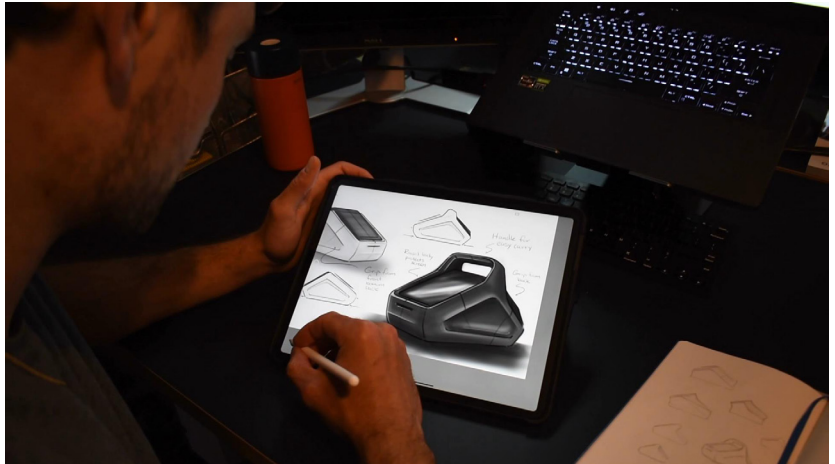
Prototyping overview (5 mins)

- Play the 'Toolkit Overview' video in the Prototype Toolkit, which will provide students with advice on developing concepts and prototyping. Explain to students that the next 2 lessons is all about going through the process to obtain an initial 3D printed prototype.



Prototyping Strategy (15 mins)

- In their teams, request that students go over the Methods, Tips and Gallery to plan out their prototyping strategy.



Make an initial 3d printed prototype (100 mins)

- Inform students that they have the remainder of this lesson plus the next lesson to obtain a 3D printable file of their initial prototype. Encourage students to explore multiple design options and to not jump straight into 3D CAD. Your role as the teacher is to take a step back and facilitate teams as necessary. After lesson 6, you should 3D print all initial prototypes in preparation for lessons 7-9, which are focused on testing and iterating.





Lessons 7-9

Testing and refining a solution
through a rigorous iterative process



Objectives

- I evaluated the functionality, ergonomics, aesthetics and production methods of my prototype.
- I used my evaluation data to develop improved iterations of my prototype.

Test + iterate overview (5 mins)

- Play the 'Toolkit Overview' video in the Test + Iterate Toolkit, which will provide students with an overview of iterative design and its importance in the field of assistive technology. Explain to students that the next 3 lessons are all about testing and refining their prototypes to achieve the best possible solution for the end user.



Test + iterate strategy (15 mins)

- In their teams, request that students go over the Methods, Tips, and Gallery sections of the Test + Iterate Toolkit to develop their strategies.



Test + iterate (160 mins)

- Inform students that they have the remainder of this lesson plus the next 2 lessons to test and refine their solutions. A key role for yourself is to carefully plan out how teams will 3D print their iterations. By lesson 10, solutions should be complete in preparation for video creation/editing. At this stage, teams should be in a routine of using their workbooks to document their journey, but remind them if need be.



Lessons 10-12

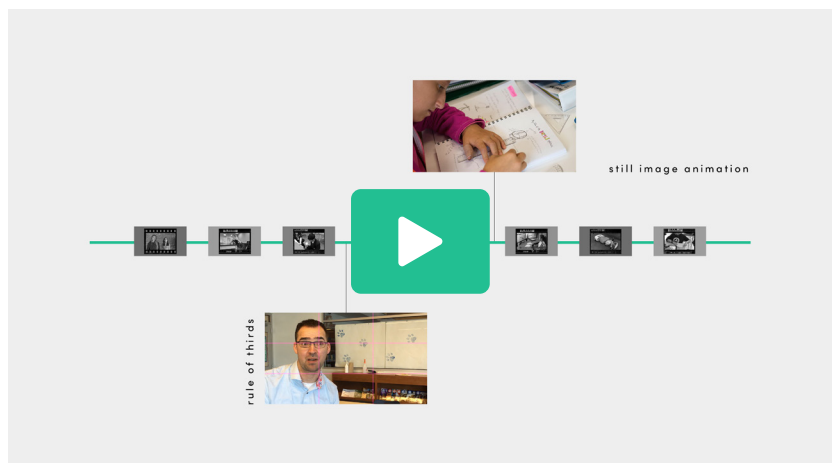
Telling your story in a short, compelling video

Objectives

- I have completed my final submission video and generated a shareable link.
- I have generated a share link (Tinkercad or Fusion) for my final digital 3D model file.
- I have captured a high-quality image of my final product.
- I have created a basic bill of materials and assembly instructions document (only required for multi-component products).
- I have had any relevant consent forms (parental consent or end user consent) signed and digitally scanned.
- I understand what model consent is and have made a decision on whether I'd like to share my design open-source.

Share your story overview (5 mins)

- Play the 'Toolkit Overview' video in the Share Your Story Toolkit, which will provide students with tips on editing and structuring their videos. Explain to students that the next 3 lessons are all about creating their videos and preparing their submissions.



Share your story strategy (35 mins)

- In their teams, request that students go over the content in the 'Example Structure' and 'Video Tips' sections. During this time, they will plan out their video strategies using the workbook, as well as map out a storyboard of each scene.



Video editing and submission preparation (140 mins)

- Inform students that they have the remainder of this lesson plus the next 2 lessons to finalise their videos and other submission requirements. Remind them to stick within the time limit of 2-4 minutes, which means they need to be very concise in their approach. Once completed, each team can submit their entries using the online form in the Share Your Story toolkit.



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