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Year 7 Istem program

**2020**

Abstract

The following program was developed as a collaboration with the STEM Industry School Partnerships (SISP) program and TAS teachers from Cessnock High School. It has been designed to meet the localised needs of the school and as an Academy of STEM Excellence. Project Leader: Ms Peggy Mangovski

Unit 1: Exploring the ‘E’ in STEM – 7iSTEM – Stage 4 Program

## Summary

## What is STEM? Why should we study STEM? Students will explore these questions and develop a deeper understanding of STEM skills and the connections between the disciplines of STEM. Throughout the year, students will explore each component of STEM through hands on practical learning activities, starting with Engineering. Students will expand their understanding of the iSTEM process, an iterative engineer design framework, which will underpin all further STEM learning in Stage 4 & 5. Both individual and group work learning activities will be used to strengthen essential skills, such as communication, collaboration, creative problem solving, critical thinking and cognitive flexibility. Students will be exposed to emerging technologies and develop the foundation skills for transferring STEM knowledge and identifying the interconnections of STEM in all curriculum learning areas.

## Duration

8 weeks

Outcomes

**1.1** uses the iSTEM engineering design process to create and critically evaluate STEM based solutions to real world problems  
**1.2** uses a variety of communication tools and creative thinking strategies in the completion and evaluation of STEM based activities  
**1.3** develops an inquiry-based mindset in the investigation of local, regional, national and global problems  
**2.1** safely use a range of manufacturing technologies in the development of STEM based practical projects  
**2.3** demonstrates spatial drawing skills in the completion of 2D and 3D designs using a variety of drawing tools and software

**2.4** applies mathematical, technological skills and scientific principles in the completion and evaluation of practical STEM based problem solving activities  
**3.2** works collaboratively to design, produce and evaluate innovative solutions to a range of real-world STEM based problems  
**4.2** investigates current and emerging STEM opportunities, careers and educational pathways  
**4.3** explains the ethical implications of STEM in the real world

## Unit overview

In Exploring the E in STEM, students will define and identify STEM skills before dissecting the Engineering elements of STEM to gain a greater understanding of how to ‘think like an Engineer’, to creatively solve problems using an iterative design process (iSTEM Process) to produce prototypes for a variety of engineering challenges. As students engage in engineering challenges, they will strengthen key skills in in collaboration, communication, creativity and critical thinking, as well as fundamental STEM skills, such as construction techniques and problem solving strategies. Students will also explore Engineering careers, global and local engineered solutions and the social and ethical concerns affecting STEM industries, such as equity and diversity.

## Resources overview

The resources and links listed below are referenced within the program, but is not an exhaustive list of resources available. Teachers can add to these resources as needed.

### Physical resources

* Projector or smartboard, laptops or tablets
* Google Classroom & Google Suite
* Paper and various craft supplies / equipment, such as pipe cleaners, scissors, rubber bands etc.
* Construction tools, such as lego
* Minecraft for education (optional)
* 3D Splat Tools or [paper download](https://drive.google.com/file/d/17u0WtTP9HqNOOe-YE1WXwAaLZPbc4kx9/view?usp=sharing) to make a Splat
* Save Fred & Spaghetti Tower supplies
* Careers with STEM magazines

#### Websites

* [Save Fred](https://www.giftofcuriosity.com/can-you-save-fred/) - templates & Instructions
* [Design a Compu Monster](https://docs.google.com/document/d/1DxrmxKsmjniacMWolax5D6PZojK68QVQgWBVnMXhWFo/edit?usp=sharing) – instructions
* [iSTEM process](https://drive.google.com/drive/folders/1xLiIA1yYyPvHaYTwEqZPLd1Lp33evhWQ?usp=sharing) – posters & activities
* [KWL Chart](https://docs.google.com/document/d/1q3S0K9KSnr1Xaa85anSL7x2IH5Q2SUvkynaSgdKKlzE/edit?usp=sharing) – template for discussions or readings
* [Spaghetti Marshmallow Challenge](https://tinkerlab.com/spaghetti-tower-marshmallow-challenge/) – instructions
* [Bell Tower Challenge](https://teachersareterrific.com/2019/07/the-great-spaghetti-challenge-and-few.html) – instructions
* [How to use a Splat tool](https://splat3d.com/wp-content/uploads/2019/12/FREE-DOWNLOAD-HOW-TO-USE-A-SPLAT.pdf) – PDF with links to video tutorials
* [Make a Splat tool](https://drive.google.com/file/d/17u0WtTP9HqNOOe-YE1WXwAaLZPbc4kx9/view?usp=sharing) – PDF instructions
* [Tea Jiggler Challenge](https://drive.google.com/file/d/1iMqTPQjoCJFg4ZEKlmcFoFDUMEtp76BZ/view?usp=sharing)– Nuts & Bolts Portfolio iSTEM Process Design Challenge
* [Marble Run](https://tinkerlab.com/toilet-paper-roll-marble-run/) – instructions
* [10 Best Rube Goldberg Machines](https://coolmaterial.com/roundup/rube-goldberg-machines/) – website with video examples
* [Careers in STEM Quiz](https://www.thegist.edu.au/students/quiz-and-careers/the-gist-quiz/) – careers with STEM
* [A-Z in STEM Careers](https://www.thegist.edu.au/students/quiz-and-careers/careers-a-z/) - careers with STEM
* [6 Engineering Myths Busted](https://careerswithstem.com.au/6-engineering-myths-busted/)
* [Engineers Australia website](https://www.engineersaustralia.org.au/For-Students-And-Educators/Engineering-Careers/What-Is-Engineering)
* [Why Diversity Is Key To The Future Of Engineering](https://engineeringonline.ucr.edu/blog/why-diversity-is-key-to-the-future-of-engineering/)
* [Tech bias puts millions at risk of unemployment, unfair treatment](https://careerswithstem.com.au/tech-bias-puts-millions-risk-of-unemployment-unfair-treatment/)
* [Women in Engineering: Realising Productivity and Innovation Through Diversity](http://www.professionalsaustralia.org.au/professional-women/wp-content/uploads/sites/48/2014/03/Women-in-Engineering-realising-productivity-and-innovation-through-diversity.pdf)
* [Girls in STEM](https://www.thegist.edu.au/students/changing-the-world-with-stem/young-women-in-stem/)
* [Women Make Up Only 16% Of Australia’s STEM Fields And That’s A Problem](https://www.fya.org.au/2018/03/08/women-make-16-australias-stem-fields-thats-problem/)
* [Women in Engineering Movement in Australia](https://www.engineersaustralia.org.au/sites/default/files/resource-files/2017-01/TheWomenInEngineeringMovementInAustralia.pdf)
* [More women in engineering: the pipeline isn’t the problem](https://www.engineersaustralia.org.au/sites/default/files/resource-files/2017-09/Benita_Pipeline.pdf),
* [Diversity in engineering: 12% of women is not enough](https://www.engineersaustralia.org.au/News/diversity-engineering-12-women-not-enough)
* [Increasing the number of women in engineering, one role model at a time](https://www.createdigital.org.au/increasing-the-number-of-women-in-engineering-one-role-model-at-a-time/)
* [The Wikipedia warrior for women in STEM](https://careerswithstem.com.au/wikipedia-warrior-women-in-stem/)
* [World Health Organisation website](https://www.who.int/news-room/fact-sheets/detail/sanitation)

#### Videos

* [Google Drawing Tutorial](https://youtu.be/PzNzF7vOVes) – for students
* [Crash Course Kids:](https://www.youtube.com/playlist?list=PLhz12vamHOnZ4ZDC0dS6C9HRN5Qrm0jHO) Engineering Playlist
* [Teach our children to be makers](https://youtu.be/jqaLWOnRozA)
* [What is Engineering](https://youtu.be/bipTWWHya8A)
* [Bill Gates Thinks These Toilets Can Change the World](https://youtu.be/_uvzKzWpRNI)

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| **Content** | **Teaching and learning** | **Evidence of learning** | **Adjustments and registration** |
| **Week 1-2 (Why STEM)**   * Use digital tools to design and communicate. * Practice essential skills by solving engineering based mini challenges. * Define STEM (Science, Technology, Engineering and Mathematics). * Identify existing STEM skills and areas of STEM interest. * Familiarise with the iSTEM process. | **Teacher**   * Outline classroom expectations. * Demonstrate Google Classroom (logging in and accessing files). * Outline and define essential skills (communication, collaboration, creative problem solving, critical thinking and cognitive flexibility). * Demonstrate how to find and use [Google Draw Tools](https://youtu.be/PzNzF7vOVes). * Direct students to complete the ‘[Design a Compu Monster’](https://docs.google.com/document/d/1DxrmxKsmjniacMWolax5D6PZojK68QVQgWBVnMXhWFo/edit?usp=sharing) activity using Google Draw; encourage students to share their designs as an ice-breaker activity; complete / finish as homework if needed. * Introduce the unit by defining STEM, STEM skills and demonstration of the iSTEM process (most students would be familiar with the Stage 3 iSTEM process from primary school; highlight differences between Stage 3 & 4; [see posters](https://drive.google.com/drive/folders/1xLiIA1yYyPvHaYTwEqZPLd1Lp33evhWQ?usp=sharing) – recommend printing Stage 4 and placing around the room). * Implement and design a pre-unit survey to assess student STEM skills and interests; the [continuum of STEM skills](https://drive.google.com/drive/folders/1xLiIA1yYyPvHaYTwEqZPLd1Lp33evhWQ?usp=sharing) can be used as a guide; use Google Forms, Kahoot, etc; once completed share data & diagram profiles with students. * Setup and outline the rules for the [Save Fred](https://www.giftofcuriosity.com/can-you-save-fred/) collaboration activity; encourage discussion on the value of essential skills.   **As a class**   * Share Compu Monster drawings and discuss common patterns and differences in the class; icebreaker activity. * Class discussion (using a campfire strategy, posing a different question at the start of each lesson; optional use a [KWL chart](https://docs.google.com/document/d/1q3S0K9KSnr1Xaa85anSL7x2IH5Q2SUvkynaSgdKKlzE/edit?usp=sharing) as a scaffold for before & after each discussion); * What does the acronym STEM stand for? * What does it mean to have STEM skills? * What is a STEM Career? * What are essential skills and why are they important in STEM? * What is the iSTEM Process? Why is it useful? * What does an Engineer look like? (see Draw an Engineer activity below; could be completed as a homework individual task / flipped learning then shared in the class). * Watch the following videos; encourage students to record 3 interesting points from each video: * [Teach our children to be makers](https://youtu.be/jqaLWOnRozA) (4 mins) * [What is Engineering](https://youtu.be/bipTWWHya8A)? * In groups of 3 or 4, complete the [SAVE FRED](https://docs.google.com/document/d/1DxrmxKsmjniacMWolax5D6PZojK68QVQgWBVnMXhWFo/edit?usp=sharing) challenge.   **Students**   * Login and access Google Classroom and familiarise with classroom expectations. * Use Google draw to follow along with the Compu Monster activity instructions; share Monsters with the class. * Engage in class discussion at the start of each lesson to define STEM; complete pre-unit survey. * Draw ‘What does an engineer look like?’; choice of digital or hand drawn; display around the classroom. * Take digital notes during class videos; record three important points from each video. * Identify the parts of the iSTEM process; demonstrate an understanding of an iterative design process. * Students to choose a partner based on different Compu Monster features (key is to encourage students to work with someone they don’t know or have different Compu Monster features); complete the [Save Fred challenge](https://docs.google.com/document/d/1DxrmxKsmjniacMWolax5D6PZojK68QVQgWBVnMXhWFo/edit?usp=sharing).   **Optional Adjustments**   * Complete unit pre-survey as homework. * Use the Compu Monster activity as a basis of a whose who in the zoo activity. * Complete drawing activity ‘What does an engineer look like?’ as homework.   **Optional Extension**   * Complete the [Careers in STEM Quiz](https://www.thegist.edu.au/students/quiz-and-careers/the-gist-quiz/) to identify potential careers based on student interests. * Dig deeper with the [A-Z in STEM Careers](https://www.thegist.edu.au/students/quiz-and-careers/careers-a-z/) list. * Write a back story on how Fred ([SAVE FRED](https://www.giftofcuriosity.com/can-you-save-fred/)) ended up in the water. * Using recycled materials or classroom equipment (such as Lego), design and construct a rescue device to save Fred. | * Students demonstrate profient use of Google Classroom. * Students to be able to demonstrate knowledge of the iSTEM process. * Students demonstrate the ability to use follow a set of instructions * Students demonstrate an ability to use graphic drawing skills (digital and hand-drawn) to communicate ideas * Students articulate an understanding of: * Classroom expectations * The disciplines of STEM * Importance of essential skills * Definition of STEM * the iSTEM process and iterative design. * Students demonstrate an ability to record ideas and information from a variety of sources through digital note-taking. * Students work collaboratively and apply creative problem solving skills to solve problems. |  |
| **Week 3 - 4 (Exploring the E in STEM)**   * Hypothesize and refine the definition of an Engineer. * Compare the work and skills of different Engineers. * Identify the S,T & M skills needed in multiple Engineering careers. * Explore stereotypes, equity and diversity within Engineering and STEM disciplines. * Apply essential skills to solve engineering challenges. | **Teacher**   * Ask students to share their “What does an Engineer look like?” drawing with the class; class discussion or display around the classroom. * Print a copy or digitally display the article ‘[6 Engineering Myths Busted](https://careerswithstem.com.au/6-engineering-myths-busted/)’; split students into 6 groups and assign each group a myth to read. * Prior to the lesson, create cards, strips or post it notes with a different discipline of Engineering from [Engineers Australia website](https://www.engineersaustralia.org.au/For-Students-And-Educators/Engineering-Careers/What-Is-Engineering); students will randomly choose from the options created; depending on the number of  students in the class duplicate cards of the same discipline may be needed. * Organise the students into small groups; each group member should have a different Engineering discipline card and have prepared summaries of the card allocated; facilitate group discussion of students research findings and ask prompting   questions to help students dig for deeper understanding; encourage students to identify S, T & M connections within each Engineering disciplines.   * Outline the definition of equity and diversity; encourage and prompt students to consider both gender and cultural diversity in STEM through class discussion; conduct a debate on the topic after students have completed their CASE study investigations. * Organise supplies, introduce the [Spaghetti Marshmallow Challenge](https://tinkerlab.com/spaghetti-tower-marshmallow-challenge/) and randomly allocate groups to complete the challenge (practical lesson 1 hour). * Instruct students to download the [Splat Tool template](https://drive.google.com/file/d/17u0WtTP9HqNOOe-YE1WXwAaLZPbc4kx9/view?usp=sharing); supply cardboard, pencils, scissors, etc to construct and decorate a large format A4 Splat tool; student can complete this challenge progressively between research or discussion activities; this could be assigned as homework if needed.   **As a Class**   * Explore & compare the differences between the definitions and impacts of equity and diversity in STEM. Recommended resources for shared reading and analysis: * ‘[Why Diversity Is Key To The Future Of Engineering](https://engineeringonline.ucr.edu/blog/why-diversity-is-key-to-the-future-of-engineering/)’ * ‘[Tech bias puts millions at risk of unemployment, unfair treatment](https://careerswithstem.com.au/tech-bias-puts-millions-risk-of-unemployment-unfair-treatment/)’ * Evaluatethe graphs in the ‘[Women in Engineering: Realising Productivity and Innovation Through Diversity](http://www.professionalsaustralia.org.au/professional-women/wp-content/uploads/sites/48/2014/03/Women-in-Engineering-realising-productivity-and-innovation-through-diversity.pdf)’   **Student**   * After reading the article [6 Engineering Myths Busted](https://careerswithstem.com.au/6-engineering-myths-busted/), students work collaboratively (groups of 2 – 3) to write a definition of an Engineer and then share with the class. * Randomly choose an Engineer Discipline card, visit the [Engineers Australia website](https://www.engineersaustralia.org.au/For-Students-And-Educators/Engineering-Careers/What-Is-Engineering), summarise the discipline and search the internet for an example of a solution created by the discipline. * Share their research findings of an allocated Engineer discipline with their group. Each student should verbally communicate their discipline with other group members asking questions to clarify their understanding and write an outline of each discipline. * Students modify or redo their “What an Engineer looks like” drawing and outline or discuss how their perceptions have changed. * In groups, students complete the Spaghetti Marshmallow Challenge. * Download, construct and decorate an A4 size Splat tool. Complete a chosen Splat tool tutorial from the Splat 3D Website.   **Optional Adjustment**   * Refraction Media frequently distributes the Careers with STEM magazine and other [resources](https://careerswithstem.com.au/teacher-hub/) to schools to support STEM education and awareness; start lessons with 10 minutes reading time which can be done as individuals, shared group reading or shared class reading. * Coordinate a community, university, business chamber or industry representative to a school visit or organise an International Women’s Day breakfast / event. ***Tip:*** [*STEM Industry in Schools Partnership,*](https://sispprogram.schools.nsw.gov.au/)[*Engineers Australia*](https://www.engineersaustralia.org.au/Contact-Us)*,* [*Regional Development Australia*](https://www.rda.gov.au/) *and* [*STEM Women*](https://www.stemwomen.co.uk/) *have resources available to connect schools with local contacts for mentors or resources.*   **Optional Extension**   * Extend the Spaghetti Tower challenge to the [Bell Tower Challenge](https://teachersareterrific.com/2019/07/the-great-spaghetti-challenge-and-few.html); discuss the differences between material strengths. * Use Splat 3D tool to hand draw isometric representation of a tool used in a students allocated Engineering Disciplines. * Conduct a Case Study analysing the potential contributing factors diverse representation in STEM careers. For example, lower female representation in STEM & Engineering; recommended resources: Foundation of Young Australian (FYA) article ‘[Women Make Up Only 16% Of Australia’s STEM Fields And That’s A Problem](https://www.fya.org.au/2018/03/08/women-make-16-australias-stem-fields-thats-problem/)’, ‘[Women in Engineering Movement in Australia](https://www.engineersaustralia.org.au/sites/default/files/resource-files/2017-01/TheWomenInEngineeringMovementInAustralia.pdf)’, ‘[More women in engineering: the pipeline isn’t the problem](https://www.engineersaustralia.org.au/sites/default/files/resource-files/2017-09/Benita_Pipeline.pdf), ‘[Diversity in engineering: 12% of women is not enough](https://www.engineersaustralia.org.au/News/diversity-engineering-12-women-not-enough)’ and ‘[Increasing the number of women in engineering, one role model at a time](https://www.createdigital.org.au/increasing-the-number-of-women-in-engineering-one-role-model-at-a-time/)’, ‘[The Wikipedia warrior for women in STEM](https://careerswithstem.com.au/wikipedia-warrior-women-in-stem/)’ and career profiles of female engineers, such as [Katrina Lo Sourdo](https://careerswithstem.com.au/profiles/robotics-engineer/), [Monique Hollick](https://careerswithstem.com.au/profiles/dst-monique-hollick/), and [Kelsie Clarke](https://careerswithstem.com.au/profiles/engineers-without-borders-director/). Further examples of women in STEM can be found at the [Careers with STEM](https://careerswithstem.com.au/women-in-stem/) website; additional statistics available via the [Girls in STEM](https://www.thegist.edu.au/students/changing-the-world-with-stem/young-women-in-stem/) website. | * Students apply critical thinking skills to explore stereotypes, diversity and equity issues within STEM fields. * Students develop a shared definition of Engineering and evaluate personal perceptions of Engineering as a discipline. * Students use a variety of graphic drawing skills and tools to communicate and record ideas. * Students select appropriate tools and varied research material or sources to investigate engineering disciplines. * Students demonstrate effective communication, collaboration, creative problem-solving and critical thinking skills to complete engineering challenges. * Students engage in varied discussion formats, including pairs, small groups and whole class discussions to share ideas and respectfully reflect on the ideas of peers. |  |
| **Week 4 – 8 (Exploring the E in STEM)**   * Identify various engineering disciplines. * Explore global engineered solutions and the links between STEM skills in designing and global solutions. * Select appropriate tools and equipment to design prototype solutions. * Experiment with materials to design, test and modify prototype designs. * Develop spatial and visual drawing skills using a variety of tools. * Extend construction and problem solving skills to collaboratively design engineered solutions. | **Teacher**   * Prior to lessons, create a list or study cards (name on one side, short description on the back) of each discipline from the [Engineers Australia website](https://www.engineersaustralia.org.au/For-Students-And-Educators/Engineering-Careers/What-Is-Engineering). From the EA website, read out the introduction paragraphs ‘Engineering Disciplines & The Main Disciplines’. Use the list or study cards to either call out the name of the discipline with students providing a definition or call out the short description with students providing the name of the discipline. ***Tip:*** *This could be completed as an informal review quiz, via class discussion or as a hands on matching game with several sets of cards created (recommended).* * Explain the importance of different Engineering disciplines working together to solve problems of varying scales; ‘[Bill Gates Thinks These Toilets Can Change the World](https://youtu.be/_uvzKzWpRNI)’ video is a recommended resource for a large scale global issue; use prompting questions to encourage students to discuss the global problem of sanitation. * Display the iSTEM process (Stage 4) and review each of the steps. The iSTEM process is an engineering design process used to demonstrate learning and provide a scaffold or template of how a problem is solved. Provide examples of each step and ask prompting questions for each step of the process (refer to examples from the ‘Bill thinks these toilets could change the world’ video), such as: * Why is it important to identify constraints? * Why would we want to create a prototype? * What are the different ways we can communicate our solutions? * Outline **Assessment Task 1:** Jiggler or Roll; groups to decide on a design challenge, select appropriate tools and materials for construction, use the iSTEM process to document prototype development and create a short video of a functional prototype (folios must include an isometric drawing ie Splat Tool):  1. Explain the concept of a Rube Goldberg solution and who Rube Goldberg was. Using a video(s), demonstrate examples of [Rube Goldberg machines.](https://coolmaterial.com/roundup/rube-goldberg-machines/) 2. Explain the [Tea Jiggler Design](https://drive.google.com/file/d/1iMqTPQjoCJFg4ZEKlmcFoFDUMEtp76BZ/view?usp=sharing) Challenge; videos embedded in the design folio booklet.   **As a class**   * Class discussion (based on the Bill Gates video)–  1. What type of STEM skills were being used? 2. Was there more than one type of Engineer represented in the video? 3. Is sanitation a local, national, or global problem? 4. Why is sanitation a complex problem to solve (factors contributing to the problem)?   **Students – in Groups (2 -3)**   * + - Match Engineering disciplines to the descriptions.     - Engage in class discussion regarding the Global solution example (Bill thinks these toilets will save the world).     - Choose a design challenge (Rube Goldberg or Tea Jiggler Challenges); using the iSTEM process develop a prototype for the chosen challenge.     - Apply spatial and visual drawing skills to communicate design ideas.     - Showcase group prototype solution and submit an iSTEM process portfolio and short video of prototype function for marking.   **Optional Adjustment**   * Students to create functional prototypes in a virtual environment such as Minecraft for Assessment Task 1.   **Optional Extension**   * Use the large format Splat tool to follow along with a chosen [YouTube video to practice isometric](https://www.youtube.com/channel/UCYOIsVIn_hW35KGYahHWrZQ) drawing skills. * Students choose 2 of the ‘most interesting’ disciplines of Engineering (EA Website) and create a slideshow, poster or explainer video to compare to, communicate what each discipline does, what type of problems are solved by engineers in that discipline, an example of an emerging solution created by someone in the discipline (solutions could be local, national or global) and a profile of an engineer working in the discipline. * Continue to explore global sanitation issues. The Netflix series ‘Inside Bills Brain’ and / or the [World Health Organisation website](https://www.who.int/news-room/fact-sheets/detail/sanitation) are suitable resources. | * Students effectively use a variety of visual illustration techniques, including traditional and digital tools. * Students critically analyse design ideas and select the most suitable design for further development. * Apply mathematical skills for measurement and proportion to create scaled drawings. * Students demonstrate an understanding of the complexity of global problems and the related industries involved in designing global solutions. * Students demonstrate knowledge of engineering principles and the iterative design process to construct a simple engineered prototype. * Students read and interpret instructions. * Students articulate the common skills and identify differences between multiple engineering disciplines. * Students apply mathematical skills for measurement and geometric shapes to draw visual isometric representations of design concepts. * Students work collaboratively to develop processes to solve set problems related to prototype production. * Students demonstrate communication and creative thinking skills in the development of a prototype concept. |  |

## Evaluation

Evaluation of learning activities should be an ongoing process that happens throughout the delivery of this unit. Teachers should document their evaluation of learning activities throughout the program. The space provided below is to evaluate the overall unit of work.

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Unit 2: Tinkering with the ‘T’ in STEM – 7iSTEM – Stage 4 Program

## Summary

## After having developed an understanding of STEM skills and applying engineering principles through a range of design challenges, students will begin to expand their skills in computer programming using a variety of tools from the Cessnock Academy of STEM Excellence Lending Library. Block-based coding is a foundation of developing computer science knowledge and skills. Computer programming is a top future focused skill with many STEM careers requiring programming skills or knowledge of application to successful design solutions for the modern world in which we live.

## Duration

11 weeks

Outcomes

**1.2** uses a variety of communication tools and creative thinking strategies in the completion and evaluation of STEM based activities

**1.3** develops an inquiry-based mindset in the investigation of local, regional, national and global problems

* 1. safely use a range of manufacturing technologies in the development of STEM based practical projects

**2.2** demonstrates an understanding of block-based and text-based computer programming skills and applies the ethical use of digital technologies to the completion of STEM projects  
**2.4** applies mathematical, technological skills and scientific principles in the completion and evaluation of practical STEM based problem solving activities  
**3.3** simulates and investigates skills relevant to STEM based industries  
**4.3** explains the ethical implications of STEM in the real world

## Unit overview

In Tinkering with the T in STEM, students will develop block-based coding skills while experimenting with micro-controllers and robotics to complete various computer coding challenges. Students will further develop critical and creative problem solving skills as they learn to detect and debug computer programming errors in fun practical projects. Students will also explore the ethical concerns of emerging technology solutions such as robotics and artificial intelligence. The skills learned in the unit will underpin further iSTEM learning across Stage 4 & 5.

## Resources overview

The resources and links listed below are referenced within the program but is not an exhaustive list of resources available. Teachers can add to these resources as needed.

### Physical resources

* Projector or smartboard, laptops or tablets
* Google Classroom & Google Suite
* Paper and various craft supplies / equipment, such as pipe cleaners, scissors, rubber bands etc.
* Microbit class sets, alligator clips, nails and compatible servo motors (Lending Library)
* Turing Tumbler Kits (Lending Library)
* Sphero robotics sets: SPRK and Mini (Lending Library)
* Marty Robot sets (Lending Library)
* 3D Splat tools (optional)
* [Tello Edu Software](https://play.google.com/store/apps/details?id=com.wistron.telloeduIN&hl=en_US)

#### Websites

* [Computer Science Unplugged: Parity Magic (Binary)](https://csunplugged.org/en/topics/error-detection-and-correction/unit-plan/parity-magic/) – lesson resources
* [Computer Science Unplugged: Binary Numbers](https://classic.csunplugged.org/binary-numbers/) – lesson resources
* [Computer Science Unplugged: Rescue Mission (Think like a programmer)](https://csunplugged.org/en/topics/kidbots/unit-plan/rescue-mission/) – lesson resources
* [Computer Science Unplugged: The Turing Test (Conversations with Computers)](https://classic.csunplugged.org/the-turing-test/) – lesson resources
* [Computer Science Unplugged: Intelligent Piece of Paper (Artificial Intelligence)](https://classic.csunplugged.org/artificial-intelligence/) – lesson resources
* [Computer Science Unplugged: Cryptographic Protocols (Binary Coin Toss Game)](https://classic.csunplugged.org/cryptographic-protocols/) – lesson resources
* [Computer Science Unplugged: Programming Languages (Giving Clear Instructions)](https://classic.csunplugged.org/programming-languages/) – lesson resources
* [Computer Science Unplugged: Sorting Algorithms](https://classic.csunplugged.org/sorting-algorithms/) – lesson resources
* [Computer Science Unplugged: Error Detection](https://classic.csunplugged.org/error-detection/) – lesson resources
* [Microbit Activity 1: Flashing Heart](https://makecode.microbit.org/) – introduction to coding and tutorial
* [Microbit Activity 2: Smiley Button](https://makecode.microbit.org/) - tutorial
* [Microbit Activity 3: Soil Moisture Sensor](https://makecode.microbit.org/projects/soil-moisture) - tutorial
* [Microbit](https://www.giftofcuriosity.com/can-you-save-fred/) Activity 4: Milky Monster - tutorial
* [Design a Compu Monster](https://docs.google.com/document/d/1DxrmxKsmjniacMWolax5D6PZojK68QVQgWBVnMXhWFo/edit?usp=sharing) – instructions
* [iSTEM process](https://drive.google.com/drive/folders/1xLiIA1yYyPvHaYTwEqZPLd1Lp33evhWQ?usp=sharing) – posters & activities
* [KWL Chart](https://docs.google.com/document/d/1q3S0K9KSnr1Xaa85anSL7x2IH5Q2SUvkynaSgdKKlzE/edit?usp=sharing) – template for discussions or readings
* [How to use a Splat tool](https://splat3d.com/wp-content/uploads/2019/12/FREE-DOWNLOAD-HOW-TO-USE-A-SPLAT.pdf) – PDF with links to video tutorials
* [Make a Splat tool](https://drive.google.com/file/d/17u0WtTP9HqNOOe-YE1WXwAaLZPbc4kx9/view?usp=sharing) – PDF instructions
* [Tea Jiggler Challenge](https://drive.google.com/file/d/1iMqTPQjoCJFg4ZEKlmcFoFDUMEtp76BZ/view?usp=sharing)– Nuts & Bolts Portfolio iSTEM process Design Challenge
* [Grok Learning: Make a turtle draw](https://aca.edu.au/resources/blockly-turtle/) – online coding course
* [Sphero Coding: Intro to coding using geometrical shapes](https://edu.sphero.com/cwists/preview/1671x) - tutorial
* [Sphero Coding: Journey to the Centre of the Earth](https://edu.sphero.com/cwists/preview/36704x) – challenge activities
* [Sphero Coding: Jurassic Raptor Escape](https://edu.sphero.com/cwists/preview/18611x) – challenge activities
* [Marble Run](https://tinkerlab.com/toilet-paper-roll-marble-run/) – instructions
* [Marty Robot: Scratch Setup](https://robotical.io/learn/article/4/Get%20Started%20with%20Scratch/Introduction/) – instructions & tutorials
* [Marty Robot: Scratch Programming](https://martytherobot.com/users/using-marty/program/scratch/) – tutorials
* [Marty Robot Challenge 1: Kick a Ball](https://martytherobot.com/wp-content/uploads/2019/01/marty-challenge-guide1.pdf) – activity instructions
* [Marty Robot Challenge 2: Shake Hands with Me](https://martytherobot.com/wp-content/uploads/2019/01/marty-challenge-guide2.pdf) – activity instructions
* [Marty Robot Challenge 3: Dance Party](https://martytherobot.com/wp-content/uploads/2019/01/marty-challenge-guide5.pdf) – activity instructions
* [Marty Robot Challenge 4: Microbit controller](https://martytherobot.com/2019/02/07/marty-with-scratch-the-microbit/) – activity instructions
* [Marty Robot Challenge 5: Workout with Marty](https://martytherobot.com/2020/05/04/marty-workout/) – activity instructions

#### Videos

* [Sphero YouTube Channel](https://www.youtube.com/channel/UC5EJptL-l6f4tY6lRdLm_Sw) – tutorials
* [5 Ways Alan Turing Changed the World](https://youtu.be/sT1vmAKdbYY) - video
* [What is Sphero SPRK](https://youtu.be/Yg8LmEkI_0c)? – Getting started
* [Google Drawing Tutorial](https://youtu.be/PzNzF7vOVes) – for students

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| **Content** | **Teaching and learning** | **Evidence of learning** | **Adjustments and registration** |
| **Week 9-11 (Term 1)**   * Explore computer programming tools and computer programming languages related to robotics activities. * Develop block-based computer programming skills to solve a range of practical challenges. * Investigate the ethics and stereotypes of robotics and computer programming. * Develop an understanding of how computers think and communicate. * Demonstrate an ability to follow step-by-step tutorial instructions and apply self-directed learning skills in the completion of coding challenges. | **Teacher**   * Introduce the unit by highlighting the different equipment within the Lending Library for computer programming (Microbit, Sphero Robot, Turing Tumblers, Marty Robotics) and lead discussion on student experience with software programming. * Demonstrate the Microbit (Setup [& Flashing Heart tutorial](https://makecode.microbit.org/)) and MakeCode website. * Setup coding challenges and coding log (see details below) template in Google Classroom and encourage students to progress to the next challenge activity once they have completed the previous; students should progressively submit their coding log for each tutorial / Google Classroom activity before progressing to the next activity. * Book a collaborative learning space (CHS Library) for each lesson for the first six weeks of Term 2.   **As a class**   * Class discussion (continue using the campfire strategy from the previous unit, posing a different question or shared reading activity at the start of a lesson; optional use a [KWL chart](https://docs.google.com/document/d/1q3S0K9KSnr1Xaa85anSL7x2IH5Q2SUvkynaSgdKKlzE/edit?usp=sharing) as a scaffold for before & after each discussion) – * Why do we need to learn to code? * What type of computer programming languages are there? * Who is [Allan Turing](https://youtu.be/sT1vmAKdbYY) and why is he important to computing and computer coding? * What is Cryptography? * How do computers think? What is binary? * What is a robot? * Which industries use robotics (prompt with example images)? * What is Artificial Intelligence? * Using a Round Robin Reading strategy; shared group reading of Careers with STEM Magazine articles related to careers requiring coding skills.   **Students**   * Engage in class discussion or shared reading activities at the start of each lesson to develop an understanding of computers and computer programming. * Setup a Google document to record coding tutorial progress (table – tutorial name, screenshots of completed code, date, notes on challenges encountered and / or modifications made to ‘tweak’ the code); students should develop a routine of contributing to this log every time they code. * Follow along with Microbit coding tutorials; take screen shots of finished code to include in a Coding portfolio / log; students could complete these activities as homework if provided with a Microbit to take home.   + [Microbit Activity 1: Flashing Heart](https://makecode.microbit.org/) – Introduction to coding and tutorial   + [Microbit Activity 2: Smiley Button](https://makecode.microbit.org/) - Tutorial   + [Microbit Activity 3: Soil Moisture Sensor](https://makecode.microbit.org/projects/soil-moisture) - Tutorial   + [Microbit](https://www.giftofcuriosity.com/can-you-save-fred/) Activity 4: Milky Monster – Tutorial; students to base their design on the Compu Monster they created earlier in the term * Familiarise with the Turing Tumbler Kits (Lending Library) and complete the graphic novel workbook to learn about Binary numbers and Cryptography; additional kits are available in the school library for students to continue working during breaks (optional coding club).   **Optional Extension**   * Assign [Grok Coding tutorials](https://aca.edu.au/resources/blockly-turtle/) as homework or extension work for completion over the school holidays. * More advanced students can progress to line-based coding using the javascript tab in MakeCode or line-based coding tutorials in Grok Online Courses. * Modify Tea Jiggler Project to include Microbit (timer, alarm, temperature, etc). | * Students to describe the importance of design to meet human needs. * Students demonstrate the ability to use and follow a set of instructions. * Students apply self-directed learning skills to complete tutorials. * Students record progress of coding skills in a log. * Students articulate an understanding of: * the importance of computer programming skills in STEM careers * types of computer programming languages * how a computer thinks and communicates * the relationship between robotics and artificial intelligence * how robotics are used in various industries. * Students demonstrate creative problem-solving, critical thinking and cognitive flexibility in finding, detecting and correcting computer coding errors. |  |
| **Week 1 – 8**   * Experiment with a variety of computer coding tools, including both unplugged and plugged resources. * Extend computer programming skills. * Apply essential skills (communication, collaboration, creative problem-solving, critical thinking and cognitive flexibility) to complete computer programming challenges within set timeframes. | **Teacher**   * Outline a rotational activity format to expose students to a variety of computer programming tools over the next 8 weeks; ***TIP:*** *SISP STEM Project Officer support for co-teaching lessons would be advantageous:* * 4 Tinker Time Stations (Sphero Robots, Marty Robots, Unplugged Computer Science and Drone Programming); students progress through activities at a pace suitable to learning needs. * *Tinker Time 1:* Sphero Robots -   + 1. [Sphero Coding: Intro to coding using geometrical shapes](https://edu.sphero.com/cwists/preview/1671x)     2. [Sphero Coding: Journey to the Centre of the Earth](https://edu.sphero.com/cwists/preview/36704x)     3. [Sphero Coding: Jurassic Raptor Escape](https://edu.sphero.com/cwists/preview/18611x)     4. Sphero Mini Activity Cards (Lending Library). * *Tinker Time 2:* Marty Robots –   + 1. [Marty Robot: Scratch Setup](https://robotical.io/learn/article/4/Get%20Started%20with%20Scratch/Introduction/)     2. [Marty Robot: Scratch Programming](https://martytherobot.com/users/using-marty/program/scratch/)     3. [Marty Robot Challenge 1: Kick a Ball](https://martytherobot.com/wp-content/uploads/2019/01/marty-challenge-guide1.pdf)     4. [Marty Robot Challenge 2: Shake Hands with Me](https://martytherobot.com/wp-content/uploads/2019/01/marty-challenge-guide2.pdf)     5. [Marty Robot Challenge 3: Dance Party](https://martytherobot.com/wp-content/uploads/2019/01/marty-challenge-guide5.pdf) * *Tinker Time 3:* [Tello EDU](https://play.google.com/store/apps/details?id=com.wistron.telloeduIN&hl=en_US) Simulated Drone Programming –   + 1. Planet Adventure Simulated (Automated Flight control)     2. Block Programming Challenges     3. Coding Games     4. Flight Simulator. * *Tinker Time 4:* Unplugged Computer Science activities - this group could be subdivided into smaller groups to complete a combination of challenges each lesson; some challenges take less time than other (recommend creating challenge cards) –   1. [Computer Science Unplugged: Parity Magic (Binary)](https://csunplugged.org/en/topics/error-detection-and-correction/unit-plan/parity-magic/)   2. [Computer Science Unplugged: Binary Numbers](https://classic.csunplugged.org/binary-numbers/)   3. [Computer Science Unplugged: Rescue Mission (Think like a programmer)](https://csunplugged.org/en/topics/kidbots/unit-plan/rescue-mission/)   4. [Computer Science Unplugged: The Turing Test (Conversations with Computers)](https://classic.csunplugged.org/the-turing-test/)   5. [Computer Science Unplugged: Intelligent Piece of Paper (Artificial Intelligence)](https://classic.csunplugged.org/artificial-intelligence/)   6. [Computer Science Unplugged: Cryptographic Protocols (Binary Coin Toss Game)](https://classic.csunplugged.org/cryptographic-protocols/)   7. [Computer Science Unplugged: Programming Languages (Giving Clear Instructions)](https://classic.csunplugged.org/programming-languages/)   8. [Computer Science Unplugged: Sorting Algorithms](https://classic.csunplugged.org/sorting-algorithms/)   9. [Computer Science Unplugged: Error Detection](https://classic.csunplugged.org/error-detection/)   + Divide the class into 4 teams; teams will spend 2 weeks exploring activities in each of the 2 tinker time stations   + All students record evidence of learning in their Computer Coding Log at the end of each lesson   + Teacher rotates between groups facilitating learning. * Outline the requirements of Assessment Task 2: computer coding log; Google document setup for record coding tutorial progress (table – tutorial name, screenshots of completed code, date, notes on challenges encountered and/or modifications made to ‘tweak’ the code).   **Students**   * Actively participate in tinker time station activities to extend computer science skills and knowledge. * Record evidence of learning at the end of every lesson in computer coding log; video evidence can also be used. * Set up and pack up activities each lesson. * Use equipment in a safe and responsible manner. * Work collaboratively and independently as need for each tinker time station activity.   **Optional Adjustment**   * Reduce the number of activities for each tinker time station. * Coordinate support for SISP STEM Project Officer to co-teaching during tinker time sessions.   **Optional Extension**   * Provide tinker time station activities in a break time coding club to finish or extend students chosen activities; recommend inviting older students to assist as mentors and scheduling activities on a rotation (ie: one or two tinker time station each week with student booking essential). * Conduct drone flight skill activities using the Tello (non-edu) edition during break times. | * Students apply critical thinking skills to solve a multitude of computer science related challenges. * Student demonstrate block-based coding skills using a variety of STEM tools in the Cessnock High School Lending Library. * Students use a variety of problem-solving and communication skills to complete challenge activities. * Students demonstrate safe and responsible use of all STEM equipment. * Students record evidence of learning on a regular basis for assessment task submission. * Apply mathematical and logical reasoning skills to complete computer coding activities. * Students read and interpret instructions. * Student work collaboratively to develop processes to solve set problems, including cognitive flexibility and resilience in error detection and correction. |  |

## Evaluation

Evaluation of learning activities should be an ongoing process that happens throughout the delivery of this unit. Teachers should document their evaluation of learning activities throughout the program. The space provided below is to evaluate the overall unit of work.

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Unit 3: Show Time Shadow Puppets – 7 iSTEM – Stage 4 Program

Summary

## To be successful in STEM careers, students must develop project management skills and demonstrate a strong foundation of interconnected knowledge across Science, Technology, Engineering and Mathematics. To do this, students will embark on their first Minor Task to produce iterative prototypes and explore the world of Shadow Puppets with learning guided by local Hunter entertainment artists, Curious Legends in a series of custom designed videos and learning resources. This cross-curricular unit will also make connections to other Key Learning Areas, such as English and HISE in a fun, creative project to highlight STEM skills in the entertainment industry.

Duration

12 weeks

Outcomes

**1.1** uses the iSTEM engineering design process to create and critically evaluate STEM based solutions to real world problems

**1.2** uses a variety of communication tools and creative thinking strategies in the completion and evaluation of STEM based activities  
**2.1** safely use a range of manufacturing technologies in the development of STEM based practical projects

**2.4** applies mathematical, technological skills and scientific principles in the completion and evaluation of practical STEM based problem solving activities  
**3.3** simulates and investigates skills relevant to STEM based industries  
**4.1** describes past, current and emerging solutions across STEM disciplines and contexts

**4.2** explains the ethical implications of STEM in the real world

Unit overview

Throughout the Shadow Puppet task, students will explore the traditional and emerging skills behind the art, engineering and science of puppet making by manipulating light, mastering movement, prototyping concepts and designing shadow creatures.

Students will apply Science, Technology, Engineering and Mathematics connections to the creations of shadow puppets while practicing iterative design using the iSTEM Process. By the end of the unit, students will have completed a design folio to showcase shadow creature designs and completed cross-curricular learning activities as they develop a variety of shadow puppets using everyday recycled materials. Student learning will be guided by industry representatives and master puppet performers from Curious Legends in a series of interactive, follow along videos. Student worksheets have been designed by expert STEM educators from the STEM Industry in School Partnerships program to ensure students develop a greater understanding of STEM connections and career pathway opportunities in the Entertainment Industry. In particular, students will explore biology, physiology, angles, measurement, light, shadow, script writing and history related to shadow puppetry, as well essential engineering construction techniques to simulate movement and iterative prototype production.

Resources overview

The resources and links listed below are referenced within the program, but is not an exhaustive list of resources available. Teachers can add to these resources as needed.

* + 1. Physical resources
* Projector or Smartboard, laptops or tablets
* Google Classroom & Google Suite
* Paper and various craft supplies / equipment, such as paper, manilla folders or poster boards, craft supplies, scissors, tape etc (supplies for each Show Time activity are listed in the Tutorial or Worksheets Guides).
* Light source, backdrop and video recording devices (Lending Library)
* Show Time Student Work booklet & Videos
  + - 1. Websites
* iTeachSTEM (in development; links available Term 3 2020)
* [STEM Industry in Schools Partnership Program](https://sispprogram.schools.nsw.gov.au/) – Show Time unit supplementary resources (worksheets & videos)
* [Curious Legends](https://www.curiouslegends.com.au/) – puppet theatre company
* [Light & Shadows](https://www.sciencelearn.org.nz/resources/2771-light-and-shadows) – science Learning Hub
* [Light & Shadow Games](https://www.sciencekids.co.nz/gamesactivities/lightshadows.html) – science Kids
* [Light and shadow Interactive PowerPoint](http://www.scootle.edu.au/ec/viewing/L756/index.html) – Scootle Activity
* [Light Investigations Unit](https://stileapp.com/au/library/publishers/csiro/compilations/science/752de271-70b9-45b9-8262-527985635909/preview/2-investigation-shadows/zgv0) – STILE
* [How Light Travels](http://www.open.edu/openlearncreate) – teacher Resource
* [Bird Flight & Wing Shape (Adaptations)](https://www.sciencelearn.org.nz/resources/303-how-birds-fly) – science Learn
* [Bird Flight](http://www.earthlife.net/birds/flight.html) - Earth Life
* [How Bones Grow](http://m.kidshealth.org/kid/htbw/bones.html)
* [How muscles move](http://www.bbc.co.uk/science/humanbody/body/factfiles/workinpairs/triceps_animation.shtml) - animation
* [Read Write Think Online generator](http://www.readwritethink.org/files/resources/interactives/timeline_2/) – requires Adobe Flash enabled
* [Plot Generator](https://www.plot-generator.org.uk/movie-script/) – online script writing
  + - 1. Videos
* [Legenden Vom Licht Performance](https://vimeo.com/287962289) – large scale puppet performance by Curious Legends
* Show Time Shadow Puppet - video series
* [History of Shadow Puppetry](https://youtu.be/QFqwzuIuLkw) & Little Red Riding Hood Performance
* [How to make a shadow puppet theatre](https://youtu.be/ZM8YDVY04yk)
* [The Musculoskeletal System](https://www.youtube.com/playlist?list=PL8dPuuaLjXtOAKed_MxxWBNaPno5h3Zs8) – Crash Course Video Series
* [The Skeleton Song](https://youtu.be/h5dYvPruBFY)
* [The Skeletal System](https://youtu.be/SiBzCpg6vu8) – Bones for Kids Video
* [The 6 Types of Joints](https://youtu.be/0cYal_hitz4) – Human Anatomy for Artists
* [Easiest Way to Remember Movement Terms](https://youtu.be/aRaLjN2cTYo) – yoga demonstration of anatomy & movement
* [What is a Pentadactyl Limb?](https://youtu.be/VbmMRDDOVxg) (Evolution of Limbs) - YouTube
* [How to make shadow puppets with your hands](https://youtu.be/-6oUqb94txc) – part 3
* [Guess the Hand Shadow Animal](https://youtu.be/J-3fHDUmnf0)
* [Flight the genius of birds](https://youtu.be/aFdvkopOmw0)
* [How birds fly](https://youtu.be/3So7OMwNgy8)

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| Content | Teaching and learning | Evidence of learning | Adjustments and registration |
| **Week 9 - 11 (Term 2)**   * Investigate the history of Shadow Puppetry. * Develop an understanding of the STEM skills and equipment used in puppetry design and performance. * Apply engineering principles and construction skills to produce a shadow puppet theatre. * Apply an understanding of the iSTEM process to create a digital portfolio to record learning progression for each video activity. * Select appropriate tools and resources to complete design activities. | **Teacher**   * Introduce the unit by reviewing the iSTEM process (reference posters on the wall and prior learning early Term 1) and ask prompting questions about what a puppet vs a shadow puppet is; using videos [Legenden Vom Licht Performance](https://vimeo.com/287962289) & [History of Shadow Puppetry](https://youtu.be/QFqwzuIuLkw) .   **As a Class**   * Class discussion (continue using the campfire strategy from the previous units, to watch and discuss videos above) – * What type of puppets have you seen previously? * How are shadow puppets different from other puppets? * How are puppets used to convey messages? * How have puppets changed over time? * What STEM skills or knowledge is needed to make shadow puppets? * Watch the following videos as a class and complete the associated activities: * [Guess the Hand Shadow Animal](https://youtu.be/J-3fHDUmnf0) – call out the names of animals as they appear in the video. * [How to make a shadow puppet theatre](https://youtu.be/ZM8YDVY04yk) – in pairs construct and decorate a mini puppet theatre using either a manila folder (A3) or poster board to construct a larger version. * [How to make shadow puppets with your hands](https://youtu.be/-6oUqb94txc) – in pairs practice and film the enactment of the hand shadow puppets in the video (torches or mobile phone lights will be needed). * [STEM ntertainment: Show Time Video 1](https://sispprogram.schools.nsw.gov.au/) – in pairs complete the careers and technology Show Time worksheets.   **Students**   * Engage in class discussion based on the videos to develop an understanding of shadow puppetry skills, history and equipment. * Research the history of puppetry (Show Time Activity 1 Worksheet 3) and construct a time line using either Adobe Spark, Lucid Charts or [Read Write Think Online generator](http://www.readwritethink.org/files/resources/interactives/timeline_2/) tools.   **Optional Extension**   * Write a [short Hand Puppet Script](https://www.plot-generator.org.uk/movie-script/) based on a funny animal internet meme or animal story, perform and record a shadow puppet film. | * Students demonstrate the ability to use and follow a set of video instructions to construct a shadow theatre and enact hand shadow puppets. * Students recall and demonstrate an understanding of the iSTEM process steps. * Students articulate an understanding of: * STEM skills and equipment in puppetry design and performance * history or shadow puppetry and types of puppetry. * Students select appropriate tools to record ideas. * Students construct a timeline based on the history of puppetry in society. * Students demonstrate collaboration and creative thinking in the enactment of shadow hand puppets. |  |
| **Week 1 -2 (Term 3)**   * Demonstrate an ability to follow step-by-step tutorial instructions and apply self-directed learning skills in the completion of shadow puppet challenges. * Explore the scientific principles of light and shadow. * Apply mathematical skills and knowledge of scale, measurement, angles and percentages. | **Teacher**   * Direct students to the online Google Classroom and outline the various components of the Show Time puppet unit and the requirements for Assessment Task 3: * *Activity 1:* STEM Entertainment * *Activity 2:* Shadow & Light Explorations * *Activity 3:* Eagle Shadow Puppet * *Activity 4:* Human Shadow Puppet * *Activity 5:* Rehearsal & Performance.   **Students**   * Watch and follow along with the Show Time shadow puppet video 2: Shadow & light explorations to experiment and apply the scientific and mathematical principles of shadow puppetry; complete the following worksheets:   + - What is a shadow puppet and how do they form? (Science)     - solar eclipses     - measurement, scale and percentages     - Tik Tok My Shadow.   **Optional Adjustment**   * [Light & Shadow Games](https://www.sciencekids.co.nz/gamesactivities/lightshadows.html) – Science Kids   **Optional Extension**   * Assign activities from the following resources:   1. [Light & Shadows](https://www.sciencelearn.org.nz/resources/2771-light-and-shadows) – Science learning Hub  2. [Light and shadow Interactive PowerPoint](http://www.scootle.edu.au/ec/viewing/L756/index.html) – Scootle Activity 3. [Light Investigations Unit](https://stileapp.com/au/library/publishers/csiro/compilations/science/752de271-70b9-45b9-8262-527985635909/preview/2-investigation-shadows/zgv0) – STILE | * Students apply critical thinking skills to solve challenges related to light and shadow. * Students apply mathematical and scientific knowledge and skills related to light and shadow. * Students use a variety of problem-solving and communication skills to simulate light and shadow experimentation. * Students demonstrate safe and responsible use of all STEM equipment. * Students construct models and performances to demonstrate a practical understanding of light and shadow. * Students watch, read and interpret instructions. |  |
| **Week 3 – 4**   * Demonstrate an ability to follow step-by-step tutorial instructions and apply self-directed learning skills in the completion shadow puppet challenges. * Develop an understanding of bird wing physiology in relation to flight. * Demonstrate an understanding of simulated joint movement in birds. * Apply mathematical skills in measurement and geometry to construct an eagle shadow puppet. | **Teacher**   * Introduce the concept of bird wing physiology and how birds limbs differ from human limbs by watching [What is a Pentadactyl Limb?](https://youtu.be/VbmMRDDOVxg), [How do birds wings work](https://youtu.be/3So7OMwNgy8) and [Flight the genius of birds](https://youtu.be/aFdvkopOmw0).   **Students**   * Watch and follow along with the show time shadow puppet video 3: Eagle puppet to simulate bird flight, adapt puppet design and demonstrate wing joint movement; complete the following further investigation worksheets:   + - pentadactyl wings     - adaptations for bird flight     - comparing human and avian skeletons   **Optional Extension**   * Research and sketch different wing types for birds native to Australia. | * Students apply critical thinking skills to solve challenges related to puppet construction and simulated movement * Students apply mathematical and scientific knowledge and skills related to biology and physiology of birds. * Students use a variety of problem-solving and communication skills to simulate bird flight and wing joints. * Students demonstrate safe and responsible use of all STEM equipment. * Students construct models and performances to demonstrate a practical understanding of bird flight and anatomy. * Students watch, read and interpret instructions. |  |
| **Week 5 – 6**   * Demonstrate an ability to follow step-by-step tutorial instructions and apply self-directed learning skills in the completion shadow puppet challenges.      * Develop an understanding of human biology and physiology. * Demonstrate an understanding of simulated joint movement in humans. * Apply mathematical skills in measurement and geometry to construct a human shadow. | **Teacher**   * Introduce the concept of human biology and physiology by watching [The Skeletal System](https://youtu.be/SiBzCpg6vu8) & [The 6 Types of Joints](https://youtu.be/0cYal_hitz4).   **As a class**   * Learn and sing the [The Skeleton Song](https://youtu.be/h5dYvPruBFY) * Demonstrate joint movement using Yoga; follow along with the video [Easiest Way to Remember Movement Terms](https://youtu.be/aRaLjN2cTYo)   **Students**   * Watch and follow along with the Show Time shadow puppet video 4: Human shadow puppet to simulate articulated joints and skeletal structures in humans; complete the following further investigation worksheets:   + - our forelimb     - how bones grow     - labelling joints   **Optional Extension**   * Further investigate the human musculoskeletal system with the following activities: * assign the [The Musculoskeletal System](https://www.youtube.com/playlist?list=PL8dPuuaLjXtOAKed_MxxWBNaPno5h3Zs8) crash course video series as homework * complete the muscles & joints PowerPoint as a class (see Show Time resource folder). * Construct a [mini robotic arm prototype](https://youtu.be/tzFNHqJCwUI) with articulated finger joints (straws & string). | * Students apply critical thinking skills to solve challenges related to puppet construction and simulated movement. * Students apply mathematical and scientific knowledge and skills related to biology and physiology of humans. * Students use a variety of problem-solving and communication skills to simulate human musculoskeletal movement. * Students demonstrate safe and responsible use of all STEM equipment. * Students construct models and performances to demonstrate a practical understanding human anatomy. * Students watch, read and interpret instructions. |  |
| **Week 7– 10**   * Demonstrate an ability to follow step-by-step tutorial instructions and apply self-directed learning skills in the completion of shadow puppet challenges. * Apply the iSTEM process to design and develop puppet prototypes. * Apply essential skills (communication, collaboration, creative problem-solving, critical thinking and cognitive flexibility) to develop and produce a shadow puppet show. * Experiment with a variety of technology tools and construction techniques to produce puppet prototypes. * Demonstrate project management and collaborations skills to meet project deadlines and overcome challenges related to group work. * Simulate STEM skills used in the Entertainment Industry. | **Teacher**   * Review assessment task requirements. * Facilitate project development and guided development of an iSTEM folio. * Coordinate live stream performances or an incursion school visit of Curious Legends (Week 9). * Coordinate school based performances for community, parents or primary school students (Week 10); ***TIP:*** *SISP STEM Project Officer and CASE STEM Project Officer support to coordinate, facilitate and supervise would be advantageous.*   **Students**   * Watch and follow along with the show time shadow puppet video 5: Rehearsal & performance to learn performance techniques; complete the following:   + - setup an iSTEM process folder     - in groups of 2 or 3, brainstorm and develop a script for a puppet performance     - construct and modify puppets and props suitable to the script written     - test and evaluate the scripted performance using puppet designs; perform the script for another group (obtain and provide constructive feedback using a Plus Minus Interesting scaffold); this could also be done by recording own performances and conducting own PMI to identify areas of improvement     - modify puppets, props and scripts as needed     - perform a puppet show for a live or authentic audience (school showcase, community event or primary school presentation).     - submit iSTEM process folios for assessment.   **Optional Extension**   * Record or live stream all puppet performances for YouTube or school FaceBook distribution. * Students create reflection videos of what they learned and overcame challenges within this unit. | * Students demonstrate the ability to work collaboratively and solve problems to produce a solution within set timeframes. * Students demonstrate safe and responsible use of all STEM equipment. * Students demonstrate an understanding of the iSTEM process in the creation of a collaborative portfolio for assessment. * Students seek and provide critical feedback to improve prototypes and performances. * Students demonstrate creativity and communication skills to showcase a finished product to an authentic audience. |  |

Evaluation

Evaluation of learning activities should be an ongoing process that happens throughout the delivery of this unit. Teachers should document their evaluation of learning activities throughout the program. The space provided below is to evaluate the overall unit of work.

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Unit 4: Making the Connection with M in STEM – 7iSTEM – Stage 4 Program

Summary

## Rapid prototyping equipment, such as 3D printers, Virtual Reality and Augmented Reality devices are emerging and essential tools in many STEM industries, including AeroSpace. To effectively use 3D tools, students must have the ability to visualise objects from a 2D to a 3D form and apply mathematical concepts, such as measurement, volume and cartesian plane geometry. Students will continue to apply an iterative design process to develop space themed prototypes as they explore the applications and societal impacts of CAD (Computer Aided Design) equipment.

Duration

10 weeks

Outcomes

**1.1** uses the iSTEM engineering design process to create and critically evaluate STEM based solutions to real world problems

**1.2** uses a variety of communication tools and creative thinking strategies in the completion and evaluation of STEM based activities

**1.3** develops an inquiry-based mindset in the investigation of local, regional, national and global problems

**2.1** safely use a range of manufacturing technologies in the development of STEM based practical projects

**2.2** *(Optional)* demonstrates an understanding of block-based and text-based computer programming skills and applies the ethical use of digital technologies to the completion of STEM projects

**2.3** demonstrates spatial drawing skills in the completion of 2D and 3D designs using a variety of drawing tools and software

**2.4** applies mathematical, technological skills and scientific principles in the completion and evaluation of practical STEM based problem solving activities

**3.1** undertakes a range of team roles and responsibilities whilst productively contributing to the completion of collaborative tasks

**3.2** works collaboratively to design, produce and evaluate innovative solutions to a range of real-world STEM based problems

**3.3** simulates and investigates skills relevant to STEM based industries

**4.1** describes past, current and emerging solutions across STEM disciplines and contexts

**4.2** explains the ethical implications of STEM in the real world

**4.3** explains the ethical implications of STEM in the real world

Unit overview

Mathematics is an essential skill for all STEM based careers. Throughout the Making Connections with the M in STEM unit, students will use applied mathematics to design and develop a range of space themed solutions using emerging equipment in Virtual Reality, Augmented Reality, 3D Printing and 3D Modelling.

Students will demonstrate their understanding of the iSTEM process as they complete various design challenges in both individual and group work settings. Students will also explore the positive and negative impacts of rapid prototyping tools and altered reality platforms in society.

Resources overview

The resources and links listed below are referenced within the program, but is not an exhaustive list of resources available. Teachers can add to these resources as needed.

* + 1. Physical resources
* Projector or smartboard, laptops or tablets
* Google classroom & Google suite
* Paper, tape, pens & geometry net printables
* Merge cube devices, apps & VR goggle set
* 3D printers, software and filaments
* Splat 3D tools (optional)
* CoSpaces annual subscription (optional)
* Minecraft for education (free)

Websites

* [Williamtown RAAF Base](https://www.airforce.gov.au/about-us/bases/nsw/williamtown)
* [BAE Systems](https://www.baesystems.com/en-aus/home)
* [Lockhead Martin](https://www.lockheedmartin.com/en-au/index.html)
* [Careers in Space](https://www.industry.gov.au/strategies-for-the-future/australian-space-agency/careers-in-space) – Australian Space Agency
* [Australian Space Agency](https://www.industry.gov.au/strategies-for-the-future/australian-space-agency)
* [STEM Industry in Schools Partnership Program](https://sispprogram.schools.nsw.gov.au/)
* [Access Mars](https://accessmars.withgoogle.com/) – NASA VR experience (Google VR)
* [Take a Walk on Mars](https://www.nasa.gov/feature/jpl/take-a-walk-on-mars-in-your-own-living-room) – NASA
* [VR Mars Expedition](https://play.google.com/store/apps/details?id=com.romale.vrmissionmars&hl=en_AU) – Google Play Store
* [CoSpaces](https://cospaces.io/edu/) – Make VR & AR in the Classroom (MergeCube)
* [Google Expeditions](https://edu.google.com/products/vr-ar/expeditions/?modal_active=none)
* [TinkerCAD](https://www.tinkercad.com/learn/overview/O0H6NEYIRXTO5IU;collectionId=OY5L5E8IRXTI47Z) – Projects ([Build your own Space Station](https://www.tinkercad.com/learn/overview/OJ7NTHAIRXTO6B2;collectionId=OY5L5E8IRXTI47Z), [Balloon Powered Car](https://www.tinkercad.com/learn/overview/OIU0ZY1IRXTXIP3;collectionId=OY5L5E8IRXTI47Z), [How to Create an Alien](https://www.tinkercad.com/learn/overview/O1CTK6ZIRXTLZSH;collectionId=OY5L5E8IRXTI47Z), [Create a Space Ship](https://www.tinkercad.com/learn/overview/OJEIEJ7IRXTM0KM;collectionId=OY5L5E8IRXTI47Z), Create a [Ringed Planet](https://www.tinkercad.com/learn/overview/OQ6YFIKIRXTM0H8;collectionId=OY5L5E8IRXTI47Z), [Holiday Projects](https://www.tinkercad.com/learn/overview/OZPULYDIRXTM0M5;collectionId=OY5L5E8IRXTI47Z), [Minecraft Bobble Head](https://www.tinkercad.com/learn/overview/O0H6NEYIRXTO5IU;collectionId=OY5L5E8IRXTI47Z))
* Thingiverse – 3D Printing Projects ([Microbit Stand](https://www.thingiverse.com/thing:2144500), [Microbit Case](https://www.thingiverse.com/thing:1587942), [Moving Joint Fish](https://www.thingiverse.com/thing:4266229), [Can Cover](https://www.thingiverse.com/thing:3697022))
* Minecraft Education – Tutorials ([Coding Introduction](https://education.minecraft.net/lessons/coding-introduction/), [Alien Exploration](https://education.minecraft.net/worlds/alien-exploration/), [International Space Station](https://education.minecraft.net/challenges/a-visit-to-the-international-space-station%e2%80%8b/), [Solar Panel Setback](https://education.minecraft.net/lessons/solar-panel-setback/), [Rockets Awa](https://education.minecraft.net/lessons/rockets-away/)y, [Code the Solar System](https://education.minecraft.net/lessons/code-the-solar-system/), [Lumen Power Challenge](https://education.minecraft.net/lessons/lumen-power-challenge/))
* [Sustainability of Rapid Prototyping](https://www.materialise.com/en/blog/sustainability-scaling-and-uncertainty-3d-printing-trends-for-2020)
* [Is 3D Printing a sustainable manufacturing method](https://www.3dnatives.com/en/3d-printing-sustainable-manufacturing-method-211120185/)?
* [Guide to Green 3D Printing](https://pinshape.com/blog/guide-green-3d-printing/)
* [Positive and Negatives of VR](https://www.nextgyn.com/societal-impact-virtual-reality/)
* [Five Ways VR Will Change the World](https://www.forbes.com/sites/robertadams/2016/10/17/5-ways-virtual-reality-will-change-the-world/#20dd3f4a2b01) - Forbes
* [Virtual Reality (Good, Bad & Ugly)](https://medium.com/uxxr/virtual-reality-the-good-the-bad-and-the-ugly-fd55a02b2840)
* [Geometry Nets for 3D Shapes](https://www.math-salamanders.com/geometry-nets.html)

Videos

* [What is 3D Printing & How Does It Work?](https://youtu.be/Vx0Z6LplaMU) – Mashable explains
* [How to describe 3D Shapes](https://youtu.be/3-QwWFkz5hw)
* [Math Antics Volume](https://youtu.be/qJwecTgce6c)
* [The Future of 3D Printing](https://youtu.be/89Bx--Ubf3o)
* [Augmented Reality vs Virtual Reality](https://youtu.be/NOKJDCqvvMk)
* [What is the Merge Cube?](https://youtu.be/aJc-dD4bnE8)
* [Making 3D Printing More Sustainable](https://youtu.be/7MbiJ9cyU6w)
* [VR Flying](https://youtu.be/0YnfCSiCBQE) – DJI Drones
* [Hyper Reality](https://youtu.be/YJg02ivYzSs)

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| Content | Teaching and learning | Evidence of learning | Adjustments and registration |
| **Week 1 – 4**   * Develop an understanding of Aerospace STEM careers. * Develop an appreciation for applied mathematics in rapid prototyping and virtual reality. * Demonstrate an understanding of 2D and 3D shapes. * Apply mathematical skills in visualising, measuring and calculating volume for 3D shapes. * Apply an understanding of coordinates (X,Y & Z axis) for constructing 3D design. * Demonstrate the safe use of tools and resources to complete 3D printed products. * Explore the impacts of rapid prototyping on society. | **Teacher**   * Introduce the unit by highlighting emerging regional and national careers in Aerospace; Cessnock is approximately 45 minutes from the [Williamtown RAAF Base](https://www.airforce.gov.au/about-us/bases/nsw/williamtown) which works collaboratively with a number of Aerospace companies, such as [BAE Systems](https://www.baesystems.com/en-aus/home) . Boeing & [Lockheed Martin](https://www.lockheedmartin.com/en-au/index.html). These companies are famous for working with NASA and have been at the forefront of advancements to support the [Australian Space Agency](https://www.industry.gov.au/strategies-for-the-future/australian-space-agency). Our iSTEM process (reference posters on the wall) and STEM continuum was designed in collaboration with engineers from BAE Systems; the Hunter region offers many [Careers in Space](https://www.industry.gov.au/strategies-for-the-future/australian-space-agency/careers-in-space) opportunities which use rapid prototyping and virtual reality as essential tools for manufacturing and training. * Outline the importance of mathematical skills in STEM careers; to design VR experiences and 3D printed prototypes students must understand 3D / 2D shapes to apply geometry, coordinates (XYZ axis) and measurement in project work. * Demonstrate TinkerCAD 3D design software; explain the X, Y & Z axis (coordinate geometry); direct students to create 3D shapes and complete introductory design tutorials. * Demonstrate 3D printers available at Cessnock High School; outline assessment task 4: Modified 3D printed space objects (students follow along with chosen space themed TinkerCAD tutorials and make modifications to design before printing; products must not exceed 4cm x 4cm x 4cm measurement).   **As a class**   * Watch the following videos and complete the activities: * [How to describe 3D Shapes](https://youtu.be/3-QwWFkz5hw) – video; cut out and construct the cube and cylinder shapes from the [Geometry Nets for 3D shapes](https://www.math-salamanders.com/geometry-nets.html) printables then identify faces, edges and vertices. * [Math Antics Volume](https://youtu.be/qJwecTgce6c) – using a ruler measure the geometry nets and calculate the volume for [cube](https://www.google.com/search?ei=10_iXsDZG6CQ4-EP1Y6jmAI&q=how+to+calculate+volume+of+a+cube&oq=how+to+calculate+volume+of+a+cube&gs_lcp=CgZwc3ktYWIQAzIECAAQQzICCAAyAggAMgIIADICCAAyAggAMgIIADIECAAQCjICCAAyAggAOgQIABBHUOWXCli-nApgnJ8KaABwAngAgAGsAYgB8QSSAQMwLjSYAQCgAQGqAQdnd3Mtd2l6&sclient=psy-ab&ved=0ahUKEwiAoaX2i_rpAhUgyDgGHVXHCCMQ4dUDCAw&uact=5) and [cylinder](https://www.google.com/search?q=how+to+calculate+volume+of+a+cylinder&oq=how+to+calculate+volume+of+a+c&aqs=chrome.0.0l2j69i57j0l5.5359j0j7&sourceid=chrome&ie=UTF-8) 3D shape? * [What is 3D Printing?](https://youtu.be/Vx0Z6LplaMU) – discuss the features of different 3D printers available at Cessnock High School. * [The Future of 3D Printing](https://youtu.be/89Bx--Ubf3o) – discuss the points from the video and how 3D printing will impact on future careers. * [Making 3D Printing More Sustainable](https://youtu.be/7MbiJ9cyU6w) – research the impacts of rapid prototyping on society.   **Students**   * Use TinkerCAD to create a cube and cone in 3D space. * Follow along with tutorials to complete TinkerCAD designs; choose two of the following (modify designs to turn products into a key chain or necklace pendant; must have name printed on it and not exceed 4cm x 4cm x 4cm measurements): * [Build your own Space Station](https://www.tinkercad.com/learn/overview/OJ7NTHAIRXTO6B2;collectionId=OY5L5E8IRXTI47Z) * [How to Create an Alien](https://www.tinkercad.com/learn/overview/O1CTK6ZIRXTLZSH;collectionId=OY5L5E8IRXTI47Z) * [Create a Space Ship](https://www.tinkercad.com/learn/overview/OJEIEJ7IRXTM0KM;collectionId=OY5L5E8IRXTI47Z) * Create a [Ringed Planet](https://www.tinkercad.com/learn/overview/OQ6YFIKIRXTM0H8;collectionId=OY5L5E8IRXTI47Z) * Research the sustainability of 3D printing and the impacts of rapid prototyping on society; justify an opinion (3 paragraphs) to the following statement supported with evidence: *3D printing is not bad for the environment.* Suggested articles for reference: * [Sustainability of Rapid Prototyping](https://www.materialise.com/en/blog/sustainability-scaling-and-uncertainty-3d-printing-trends-for-2020) * [Is 3D Printing a sustainable manufacturing method](https://www.3dnatives.com/en/3d-printing-sustainable-manufacturing-method-211120185/)? * [Guide to Green 3D Printing](https://pinshape.com/blog/guide-green-3d-printing/) * 3D print a chosen 3D prototype design from above and submit for assessment task 4.   **Optional Adjustment**   * Download and modify one of the space themed Thingiverse projects listed in the resource website links.   **Optional Extension**   * Construct and calculate volume for additional geometry nets. * Complete additional TinkerCAD tutorials. * Excursion site visit to Williamtown RAAF Base or BAE representative incursion visit. | * Students articulate an understanding of: * 3D shapes * volume * XYZ coordinates * impacts of 3D printing on society * scale and proportion to 3D print objects according to size constraints * Students select and use appropriate STEM tools and resources safely and responsibly * Students construct paper 3D shape models using geometry nets * Students experiment with various 3D printer types and settings to print prototypes and quality finished products * Students demonstrate the ability to use and follow a set of tutorial instructions to construct and modify 3D models * Students apply research skills to develop and articulate a justified perspective on rapid prototyping sustainability. |  |
| **Week 5 – 7**   * Develop an understanding of 3D design skills used in Virtual and Augmented Reality. * Demonstrate the safe use of VR & AR equipment. * Explore the space themes using VR & AR technology. | **Teacher**   * Outline the application of 3D design skills in Virtual & Augmented Reality; highlight the differences between Augmented Reality and Virtual Reality. * **As a Class**   **As a Class**   * Watch and follow videos and explore discussion points before experimenting with VR and AR tools: * [Augmented Reality vs Virtual Reality](https://youtu.be/NOKJDCqvvMk) – How are VR & AR similar or different? * [VR Flying](https://youtu.be/0YnfCSiCBQE) – How can VR and drones be used in STEM careers? * [Hyper Reality](https://youtu.be/YJg02ivYzSs) – Would you like to live in an Augmented World? Why or Why Not? * [What is the Merge Cube?](https://youtu.be/aJc-dD4bnE8) – use Merge cube in pairs to explore the [Solar System app](https://play.google.com/store/apps/details?id=com.LunarExGames.myARgalaxySolarSystem) or [Space Museum App](https://play.google.com/store/apps/details?id=com.zeemel.spacemuseumvr) * [What is Google Expeditions](https://edu.google.com/products/vr-ar/expeditions/?modal_active=none)? – [Take a 360 tour of Mars](https://accessmars.withgoogle.com/) * Select appropriate tools   **Students**   * Actively participate in discussion topics related to the above videos. * In pairs - explore the Merge Augmented Reality [Cube Solar System](https://play.google.com/store/apps/details?id=com.LunarExGames.myARgalaxySolarSystem) or [Space Museum](https://play.google.com/store/apps/details?id=com.zeemel.spacemuseumvr) App. * In pairs - use VR equipment (Google Cardboard or Merge VR Headsets) to take a [360 Tour of Mars](https://accessmars.withgoogle.com/); * Students may need to rotate through Augmented and VR activities depending on the number of mobile devices and VR headsets available. * Students should always operate VR & AR equipment in pairs to prevent injury or motion sickness.   **Optional Extension**   * Use [CoSpaces](https://cospaces.io/edu/) to design a space habitat, space objects or space creature to upload / project to the merge cube (this could include computer coding; requires an annual subscription to CoSpaces EDU); potential alternate for assessment task 3 (block-based coding). * Students | * Students contribute to class discussions and apply critical thinking skills to analyse the impacts of VR and AR technologies on society. * Students demonstrate safe and responsible use of STEM tools. * Students use a variety of 3D simulated tools to explore space themes. |  |
| **Week 8 – 10**   * Demonstrate an ability to follow step-by-step tutorial instructions to collaboratively design a space habitat in 3D simulation software. * Explore space themes and Aerospace science. * Apply mathematical skills and scientific principles in construction of multiple 3D objects in a virtual simulated environment. | **Teacher**   * Introduce Minecraft for Education and learning goals for the remainder of the unit:   + Work collaboratively and respectfully to complete space themed Minecraft activities and design a Minecraft space habitat   + Record screenshots or video walk throughs of work completed at the end of each lesson; record evidence in a digital file (Google docs). * Demonstrate the login and setup process for Minecraft Education. * Outline rules and expectations for using Minecraft Education.   **Student**   * Using Minecraft for Education, design a space habitat and complete the assigned space themed activities (teacher to specify from one or more of the following): * [Alien Exploration](https://education.minecraft.net/worlds/alien-exploration/) * [International Space Station](https://education.minecraft.net/challenges/a-visit-to-the-international-space-station%e2%80%8b/) * [Solar Panel Setback](https://education.minecraft.net/lessons/solar-panel-setback/) * [Rockets Awa](https://education.minecraft.net/lessons/rockets-away/)y * [Code the Solar System](https://education.minecraft.net/lessons/code-the-solar-system/)   **Optional adjustment**   * Students cast a class vote to select the Minecraft Space Themed Challenge.   **Optional Extension**   * Students complete the [Coding Introduction](https://education.minecraft.net/lessons/coding-introduction/) and or [Lumen Power Challenge](https://education.minecraft.net/lessons/lumen-power-challenge/) in Minecraft EDU as homework. * Students use the Splat 3D tool to design a space habitat.   **Optional extension**   * Coordinate external mentors for students. * University career or student visits. | * Students apply critical thinking and creative problem-solving skills to solve challenges related to 3D modelling in a simulated virtual environment * Students apply mathematical and scientific knowledge and skills related to space themed challenges * Students demonstrate communication, collaboration and cognitive flexibility skills to construct models to demonstrate a practical understanding of Aerospace. * Students apply an understanding of an iterative design process to complete practical design tasks and virtual simulated projects. * Students demonstrate safe and responsible use of all STEM equipment and apply appropriate behaviour according to classroom expectations in an online learning environment. * Students watch, read and interpret tutorial and teacher instructions. * Students apply self-directed learning skills to complete projects within a specified timeframe. |  |

Evaluation

Evaluation of learning activities should be an ongoing process that happens throughout the delivery of this unit. Teachers should document their evaluation of learning activities throughout the program. The space provided below is to evaluate the overall unit of work.

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