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Year 8 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: Engineer It! – 8iSTEM – Stage 4 Program

## Summary

## In Year 7 iSTEM students experimented with a number of practical STEM projects and equipment, Year 8 iSTEM will draw upon and expand previous concepts while creating a strong foundation for further study in Stage 5. Year 8 begins with the original Science, Technology, Engineering and Mathematics developed by humans to improve society through invention and innovation. Students will apply an understanding of the 7 simple machines in a hands on practical project using prototyping techniques and an iterative design methodology, known as the iSTEM process. Both the theory and pratical application of simple machines and the iSTEM process which will be essential learning for the remainder of the year and beyond.

## Duration

11 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** 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  
**3.3** simulates and investigates skills relevant to STEM based industries

## Unit overview

## In the ‘Engineer It’ unit, students will be immersed in the wonderful world of Automata toys (also known as mechanical toys or kinetic art) and begin to experiment with simple machines using both paper and rapid prototyping tools available in the Cessnock High School Advanced Manufacturing Centre. Designing and creating Automata provides students with a practical hands on platform to explore force and motion while making simple machines that utilise mechanical processes (cams, gears, ratchets and cranks) that are emulated in every modern machine. The knowledge developed in this unit will be essential to further study and understand engineering principles.

## In Year 7, students experimented with 3D printing technology; in Year 8, students will expand their experience with industry standard equipment by learning to create projects using laser cutting techniques. Students will apply the iSTEM process to develop Automata Toy prototypes featuring the use of simple machines with a design based on endangered species and climate change. In this unit, students will develop an appreciation and understanding of the phases and types of prototyping as they progress their designs from throw away prototype 3D models to evolutionary prototypes professionally manufactured using a laser cutter.

## 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 & computers (Advanced Manufacturing Centre Computer Lab & Equipment Room)
* Google Classroom & Google Suite
* Mathematics tools – compass, ruler, protractor, etc.
* Paper (card stock or cardboard) and various craft supplies / equipment, such as pencils, erasers, scissors, tape, glue, etc (paper prototypes), scalpels, hot glue guns (cardboard prototypes)
* Laser Cutter and software
* Ply board or Perspex

#### Websites

* [Simple Machine](https://www.britannica.com/technology/simple-machine)- encyclopedia Britannica website (Teacher resource)
* [What is a prototype?](https://www.feedough.com/what-is-a-prototype/) – examples, types & qualities
* [Mechanisms of animated paper toys](http://www.technologystudent.com/cams/camdex.htm) – teacher resource, lesson plans, scaffold etc.
  + [Types of CAMS & Followers](http://www.technologystudent.com/cams/cam1.htm)
  + [Printable template](http://www.technologystudent.com/cams/camt1.htm) for designing CAM types for Automata movement
* [Mechanical Toys](http://www.design-technology.info/page22.htm) – teacher Resource
* [Robiverse Paper Engineering Essential Mechanisms](https://www.robives.com/product/essential-mechanisms-pack-one/) – paid download templates for a variety of moving mechanisms (cams, cranks, gears & compound mechanisms) for paper automata
* Brother Creative Paper Toys – Free downloadable templates
  + ([Penguin](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/penguin), [Fox](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/fox), [Tortoise](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/tortoise), [Kangaroo](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/walking-kangaroo), [Cat](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/purring-cat), [Owl](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/owl), [Crab](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/crab))
* Thingiverse Automata Projects (Laser Cut: [Simple Machine Template](https://www.thingiverse.com/thing:32054); 3D Printed: [Sea Turtle](https://www.thingiverse.com/thing:3758189), [Polar Bear](https://www.thingiverse.com/thing:4052802), [Whale](https://www.thingiverse.com/thing:3934354))
* Instructables [Cat & Mouse](https://www.instructables.com/id/Cat-Mouse-Automaton/) laser Cut Automata – files and plans
* [Paper Models that Move](https://drive.google.com/file/d/0B9WS6C68Yi4kYjBxbUJKNU8xeFk/view) – zip file 81 printable designs
* cannon creative park – free downloadable templates
  + automata templates ([Hot Air Balloon Festival](https://creativepark.canon/en/contents/CNT-0019376/index.html), [Hatching Chick](https://creativepark.canon/en/contents/CNT-0010174/index.html), [Leaping Goat](https://creativepark.canon/en/contents/CNT-0010524/index.html), [Frog Chorus](https://creativepark.canon/en/contents/CNT-0011439/index.html), [Tasmanian Devil](https://creativepark.canon/en/contents/CNT-0024599/index.html), [Elephant](https://creativepark.canon/en/contents/CNT-0024587/index.html), [Panda](https://creativepark.canon/en/contents/CNT-0011481/index.html))
* paper craft square – Free downloadable templates
  + endangered animals ([Orca](http://www.papercraftsquare.com/zoo-tycoon-orca-free-papercraft-download.html), [Giraffe](http://www.papercraftsquare.com/giraffe-robot-free-paper-model-download.html), [Green Sea Turtle](https://www.deviantart.com/drwheeliemobile/art/Zoo-Tycoon-Paper-Collection-Green-Sea-Turtle-667482605), [White Rhino](https://www.deviantart.com/drwheeliemobile/art/Zoo-Tycoon-Paper-Collection-White-Rhinoceros-643074331), [Flying Bird,](http://www.kamibox.de/PDF/Tiny_Wings_Machine.pdf) [Bengal Tiger](https://www.deviantart.com/drwheeliemobile/art/Zoo-Tycoon-Paper-Collection-Bengal-Tiger-653141125), [Snow Leopard](https://www.deviantart.com/drwheeliemobile/art/Zoo-Tycoon-Paper-Collection-Snow-Leopard-578022031), [Emperor Penguin)](https://www.deviantart.com/drwheeliemobile/art/Zoo-Tycoon-Paper-Collection-Emperor-Penguin-703025856)

#### Videos

* [Example of Simple Machines](https://youtu.be/_fOA4nCWYms) – video
* [Example Automata Projects](https://youtu.be/CmEXTRbvbQU) – inspiration student projects
* [What are CAMS?](https://youtu.be/tzWQasmUfLY) – designing Automata movement video
* [Linkage mechanisms](https://youtu.be/xh1jTtAxs_Q) – designing Automata movement video
* [Dolphin Papercraft Automata](https://youtu.be/L3u2ylzLKS0) – tutorial
* [How to make a mechanical butterfly with cardboard and DC motors](https://youtu.be/_vIhMGnHrxo) – tutorial
* [How does a laser cutting work?](https://youtu.be/SIjUVCho_xU) (Teacher resource)
* [Adobe Illustrator](https://youtu.be/3GzumUieDPY) tutorial video – review of basic tools (Teacher Resource)

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| **Content** | **Teaching and learning** | **Evidence of learning** | **Adjustments and registration** |
| **Week 1-5**   * Apply an understanding of simple machines in a practical engineered prototype. * Use industry standard software and demonstrate an understanding of safe operation of all STEM equipment. * Develop and practice self-directed learning skills to follow written, verbal and video instructions to meet project design specifications. * Select appropriate materials, techniques and tools to construct prototypes. * Apply the iSTEM process to conceptualise, research and design an Automata toy based on an endangered animal or climate change theme. | **Teacher**   * Outline classroom rules, expectations and review STEM equipment safety; direct students to the Google Classroom for resource files and support materials. * Introduce the unit by discussing simple machines (inclined plane, wedge, lever, pulley, screw & wheel / axle) and explaining how an Automata toy uses these ideas to create motion; devices with moving parts that are used to modify motion and force to perform work; simple machines are basic mechanical devices (watch the following videos to start discussion on how to simulate motion in Automata projects): * [Example of Simple Machines](https://youtu.be/_fOA4nCWYms) (Lesson 1); encourage discussion about other complex machines that incorporate multiple simple machines ie: bicycle * [Example Automata Projects](https://youtu.be/CmEXTRbvbQU) (Lesson 1); ask students to identify examples of types of simple machines being used; inspiration video for project * [What are CAMS?](https://youtu.be/tzWQasmUfLY) (Lesson 2); discuss the purpose of a CAM and how different shapes effect motion * [Linkage mechanisms](https://youtu.be/xh1jTtAxs_Q) (Lesson 2); discuss the purpose of linkage mechanisms. * Review the iSTEM process (Lesson 2) (prior knowledge from last year; direct students to posters around the room). * Facilitate discussion on types of prototypes; highlight the reasons for and differences between throw-away prototypes and evolutionary prototypes; use the following website for discussion:   + [What is a prototype?](https://www.feedough.com/what-is-a-prototype/) * Demonstrate some examples of Paper Automata projects based on the following links (red highlighted links are highly recommend examples; recommend assigning 1 of the Brother or Cannon examples for part 1: paper prototype of the assessment task):  1. Brother Creative Paper Toys – Free downloadable templates    * ([Penguin](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/penguin), [Fox](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/fox), [Tortoise](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/tortoise), [Kangaroo](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/walking-kangaroo), [Cat](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/purring-cat), [Owl](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/owl), [Crab](https://www.creativecenter.brother/en-gb/home/home-category/paper-crafts-origami/do-it-yourself-projects/crab)) 2. Cannon Creative Park – free downloadable templates    * Automata templates ([Hot Air Balloon Festival](https://creativepark.canon/en/contents/CNT-0019376/index.html), [Hatching Chick](https://creativepark.canon/en/contents/CNT-0010174/index.html), [Leaping Goat](https://creativepark.canon/en/contents/CNT-0010524/index.html), [Frog Chorus](https://creativepark.canon/en/contents/CNT-0011439/index.html), [Tasmanian Devil](https://creativepark.canon/en/contents/CNT-0024599/index.html), [Elephant](https://creativepark.canon/en/contents/CNT-0024587/index.html), [Panda](https://creativepark.canon/en/contents/CNT-0011481/index.html)) 3. Paper Craft Square – Free downloadable templates.  * Endangered Animal Origami - ([Orca](http://www.papercraftsquare.com/zoo-tycoon-orca-free-papercraft-download.html), [Giraffe](http://www.papercraftsquare.com/giraffe-robot-free-paper-model-download.html), [Green Sea Turtle](https://www.deviantart.com/drwheeliemobile/art/Zoo-Tycoon-Paper-Collection-Green-Sea-Turtle-667482605), [White Rhino](https://www.deviantart.com/drwheeliemobile/art/Zoo-Tycoon-Paper-Collection-White-Rhinoceros-643074331), [Bengal Tiger](https://www.deviantart.com/drwheeliemobile/art/Zoo-Tycoon-Paper-Collection-Bengal-Tiger-653141125), [Snow Leopard](https://www.deviantart.com/drwheeliemobile/art/Zoo-Tycoon-Paper-Collection-Snow-Leopard-578022031), [Emperor Penguin)](https://www.deviantart.com/drwheeliemobile/art/Zoo-Tycoon-Paper-Collection-Emperor-Penguin-703025856); students can modify paper prototypes to use origami models if desired; these models could also provide inspiration for a chosen endangered animal for Part 2 of the assessment task. Explain the Automata challenge outline assessment task 1:   + *Part 1:* Students will work independently to select and construct a paper Automata prototype; provide links to paper Automata templates via google drive; students can modify designs to increase complexity or change the theme.   + *Part 2:* Students will apply the iSTEM process to design a CAD / CAM Automata prototype with the following constraints:     1. concept must be based on an endangered species or climate change theme     2. demonstrate at least 2 simple machines in the function of the prototype     3. learn the basics of Adobe Illustrator software to create laser cut items; encourage students to customise objects (cutting and engraving)     4. at least 2 elements of the prototype must include a laser cut item; 1 laser cut element must include an engraved name plate with details about the chosen animal or theme     5. if using provided templates, at least 1 Automata element (not including the name plate) must be a custom designed laser cut piece suited to the animal or theme chosen.     6. prototype can include 3D printed elements or origami models.   + *Part 3:* iSTEM process folio must be submitted with a functional evolutionary prototype based on the theme and project specifications; use blank template booklet or supply a template via Google Classroom. * Demonstrate the basics of Adobe Illustrator to cut and engrave shapes on the laser cutter; highly recommend using the name plate requirement for the basis of these tutorials to same time in a short unit; provide a template for modification only (teacher resource [Adobe Illustrator](https://youtu.be/3GzumUieDPY) Tutorial Videos).   **As a class**   * Discuss the following:   + types of simple machines and examples of everyday use.   + types of movement and simple machines used in Automata examples video.   + review of the iSTEM process.   + the purpose of CAMS and linkages in Automata.   **Students**   * Engage in class discussion and idea generation. * Watch the video tutorial - [Dolphin Papercraft Automata](https://youtu.be/L3u2ylzLKS0) (provided via link in Google classroom; this could be assigned as homework using a flipped learning strategy followed by class discussion and brainstorm session on how to design their own paper Automata). * Brainstorm and select a paper prototype Automata template provided in Google Classroom. * Apply critical, creative thinking and cognitive flexibility skills to solve paper prototype construction challenges. * Work independently to construct a paper Automata toy within specified time frames. * Begin the iSTEM process folio to determine the theme for the evolutionary functional CAD / CAM prototype. * Follow along with Adobe Illustrator tutorials to learn the basics of laser cutting design.   **Optional Adjustment**   * For students struggling with intricate paper prototype construction, use the simplified template for [Flying Bird](http://www.kamibox.de/PDF/Tiny_Wings_Machine.pdf).   **Optional Extension**   * Students customise provided paper prototype templates to include additional CAM and linkage types and or modify theme with more complex Origami construction models (see endangered species links). * Students select from a wider range of templates with increased complexity in paper prototype design; supply files via Google Classroom.   + [Robiverse Paper Engineering Essential Mechanisms](https://www.robives.com/product/essential-mechanisms-pack-one/) – paid download templates for a variety of moving mechanisms (cams, cranks, gears & compound mechanisms) for paper Automata   + [Paper Models that Move](https://drive.google.com/file/d/0B9WS6C68Yi4kYjBxbUJKNU8xeFk/view) – zip file 81 printable designs. * Use cardboard instead of card stock; see [How to make a mechanical butterfly with cardboard and DC motors](https://youtu.be/_vIhMGnHrxo) tutorial video for cardboard construction techniques. | * Students articulate an understanding of: * simple machines applied for force and motion * types of prototypes * iSTEM process * assessment 1 requirements * safety procedures in the Cessnock High School Advanced Manufacturing Centre. * Students demonstrate the ability to use and follow a set of instructions (verbal, written and video). * Students apply self-directed learning skills to construct a paper Automata prototype. * Students actively, responsibly and respectfully participate in the collaborate discussion. * Students apply project management, self-directed learning and essential skills to meet deadlines. * Students test and modify throwaway prototypes as needed. * Students demonstrate creative problem-solving, critical thinking and cognitive flexibility in solving prototype construction challenges. |  |
| **Week 6 - 7**   * Apply the iSTEM process to refine design concepts and improve function in the production of an evolutionary prototype. * Use industry standard equipment and demonstrate an understanding of safe operation of all STEM equipment. * Apply self-directed learning skills to design and produce a functional evolutionary prototype to meet project design specifications. * Select appropriate materials and tools to a functional prototype. * Showcase an Automata toy design featuring simple machines based on an endangered animal or climate change theme. | **Teacher**   * Demonstrate the laser cutter and review safety procedures in the Advanced Manufacturing Centre. * Review requirements & laser cutting constraints for assessment task 1 (see above). * Organise an end of term showcase or demonstration of student projects (this could be a recorded video for social media, primary school showcase or a parent teacher night). ***TIP:*** *SISP STEM Project Officer support to coteach / facilitate Advanced Manufacturing Centre supervision and coordinate a project showcase would be advantageous.* * Provide laser cut templates in Google Classroom for the basic laser cut or 3D printed simple machine components: * Thingiverse Automata Projects (Laser Cut: [Simple Machine Template](https://www.thingiverse.com/thing:32054); 3D Printed: [Sea Turtle](https://www.thingiverse.com/thing:3758189), [Polar Bear](https://www.thingiverse.com/thing:4052802), [Whale](https://www.thingiverse.com/thing:3934354)) * Instructables [Cat & Mouse](https://www.instructables.com/id/Cat-Mouse-Automaton/) Laser Cut Automata – files and plans. * Facilitate student project work with regular check-ins on progress; provide support and adjust resources as needed.   **Students**   * Engage teacher and video demonstration tutorials to learn Adobe Illustrator and laser cutting equipment. * Apply self-directed learning skills to design, test, modify and manufacture components for an evolutionary CAD / CAM prototype. * Demonstrate safe use of all STEM equipment. * Complete an iSTEM process portfolio to document prototype development. * Apply critical, creative thinking and cognitive flexibility skills to solve evolutionary prototype construction challenges. * Participate in the performance for an authentic audience.   **Optional Adjustment**   * Provide pre-cut laser cut simple machine parts for student construction; students construct the base then add origami, found objects and / or 3D printed parts to suit the project theme.   **Optional Extension**   * Integrate automated control of a functional prototype using a Kookaberry, Microbit or Makey Makey (prior learning from Year 7). | * Students demonstrate an understanding of the following within their finished prototype:   + simple machines to control motion   + iterative design in the iSTEM process folio   + adherence to project constraints   + safety procedures in the Cessnock High School Advanced Manufacturing Centre while manufacturing prototype components. * Students demonstrate the ability to use and follow a set of instructions (verbal, written and video). * Students apply self-directed learning skills to construct a functional, evolutionary prototype using CAD / CAM techniques and equipment. * Students apply project management, self-directed learning and essential skills to meet deadlines. * Students demonstrate creative problem-solving, critical thinking and cognitive flexibility in solving prototype construction challenges. |  |

## 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: Seeking the S in STEM – 8iSTEM – Stage 4 Program

## Summary

## In the ‘Seeking the S in STEM’ unit, students will explore the science of electricity as a foundation for developing electro-mechanical skills that will be essential in further Stage 4 & 5 iSTEM learning. Students will apply an understanding of circuits and electricity in a series of hands-on practical tasks before collaboratively building an interactive electronics project using the iSTEM process.

## 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

**2.2** 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

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

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

**4.2** investigates current and emerging STEM opportunities, careers and educational pathways

## Unit overview

## In the ‘Seeking the S in STEM’ unit, students will explore the scientific principles of electricity and begin to experiment with simple circuits in a variety of practical challenges using tools available in the Cessnock Academy of STEM Excellence Lending Library. Smaller electronics challenges will allow students to develop a foundational understanding of electromechanical engineering principles before applying skills and knowledge of circuitry to a collaborative project.

## Using the Makey Makey, scratch programming (block-based coding) and simple circuits, student teams will design an interactive singing wall to be displayed and enjoyed by their fellow peers. The knowledge developed in this unit will be essential to further study and understanding of mechatronics. Students will also briefly explore electromechanical career and education pathways.

## 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 & computers / laptops

Google Classroom & Google Suite

Makey Makey Kits (Lending Library)

Alternatives to Makey Makey (Makeblock Neuron Kits & ShakeUp Kits)

Chibitronics Kits (Basic Circuit Booklet and alternative to Makey Makey)

Art & craft supplies (paper, scissors, markers, decorations, paddle pop sticks, cardboard, crocodile / swing clips, etc; see various simple circuit challenges for details)

100 x LED lights (combination of multiple colours), 50 x coin cell batteries, 5 x copper tape rolls, 50 x copper plated nails, 5 x hammer, 5 x switches, 5 x AA battery holder, 10 x AA batteries, soldering iron & solder spool (optional), 5 x hot glue gun / glue sticks, electrical tape or heat shrink, 5 x wire stripper, servos (1.5V -3V DC motor), paper clips, split pins, Christmas tree lights, 50 x alligator clips, variety of sensor & output items (scavenge from broken toys / electronics or purchased from electronics store; see [Snapguide circuit for examples)](https://snapguide.com/guides/make-circuit-blocks/), playdoh, 20 x timber blocks (3.5” x 4”); note red items are for the SnapGuide Circuit Blocks which are an alternative to squishy or paper circuits for more advanced circuit design.

3D Printer & Laser Cutter (optional)

#### Websites

[Makey Makey](https://makeymakey.com/pages/how-to) – beginner Online Classes

[Instructables LEDs and Lighting Class](https://www.instructables.com/lesson/Electronics-Crash-Course/) – teacher resource

[Chibitronics Basic Paper Circuit Activities](https://chibitronics.com/how-to-page/) (downloadable pages)

[Instructables Craft Stick Candles](https://www.instructables.com/id/Craft-Stick-Candles/) – simple circuit activity

[Snapguide Circuit Blocks](https://snapguide.com/guides/make-circuit-blocks/) – simple circuit activities

[Instructables LED Paper Helicopter](https://www.instructables.com/id/LED-Paper-Helicopter/) – simple circuit activity

[TinkerCAD Glow Circuit](https://v1.tinkercad.com/things/glfRMjmKCay-glow-circuit-assembly/edit?lessonid=EW74NBCJ48POGA7&projectid=O2C1PXBIQ2KHCOD&collectionid=O2C1PXBIQ2KHCOD#/lesson-viewer) – 3D printed simple circuit activity

[Thingiverse Candle Circuit](https://www.thingiverse.com/thing:34330) – laser cut simple circuit activity

[Squishy Circuits](https://www.makerspaces.com/squishy-circuits/) – Makerspace recipe and resources

[Makeblock Neuron](https://www.makeblock.com/steam-kits/neuron) – product information and tutorials

[ShakeUp](https://www.littlebird.com.au/pages/shakeup-resources) – resources and tutorials

#### Videos

[Electricity: Crash Course History of](https://youtu.be/JoscDcbAjbY) Science – video

[Smart Power Generation](https://youtu.be/TD0jZciQcaE) – the future of electricity production

[Electromechanical Engineering](https://youtu.be/2p6Su4XD8yo) – video

[How an LED works](https://youtu.be/Iwv5momDiKQ) - video

[Explaining an Electrical Circuit](https://youtu.be/VnnpLaKsqGU) – video

[Types of Electrical Circuits](https://youtu.be/RQ3djos_LY8) – video

[Electricity & Magnetism](https://www.youtube.com/playlist?list=PL8dPuuaLjXtN0ge7yDk_UA0ldZJdhwkoV) – crash course playlist

[Makey Makey Maker Faire Singing Plants](https://youtu.be/BYfjj7xJGlw)

[Makey Makey Music Examples](https://youtu.be/wkPt9MYqDW0)

[Squishy Circuits](https://www.youtube.com/watch?time_continue=9&v=5M3Dow20KlM&feature=emb_logo) – hands on science

squishy circuit classroom activity [Part 1](https://youtu.be/GBuWiFM2T_o) & [Part 2](https://youtu.be/jbryDvZ7UuM)

[MakeBlock Neuron Inventor Kit](https://youtu.be/FTpNI4NCvXA) – demo video

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| **Content** | **Teaching and learning** | **Evidence of learning** | **Adjustments and registration** |
| **Week 1 - 7**   * Apply an understanding of electricity in the completion of practical simple circuit challenges. * Demonstrate safe operation of all STEM equipment. * Apply essential skills (collaboration, communication, creative problem solving, critical thinking and cognitive flexibility) skills to complete set tasks. * Select appropriate materials, techniques and tools to construct series circuit, parallel circuits and switches. * Demonstrate block-based coding skills to control interactive light and sound elements within a circuit project. * Apply the iSTEM process to conceptualise, research and design an interactive circuit project. | **Teacher**   * Introduce the unit by discussing the importance of electricity in past, current and emerging aspects of society; use the following videos to introduce concepts and initiate discussions: * [Electricity: Crash Course History of](https://youtu.be/JoscDcbAjbY) Science; students investigate one of the scientists highlighted in the video or investigate the current wars * [Smart Power Generation](https://youtu.be/TD0jZciQcaE); what is renewable and sustainable energy? * [Electromechanical Engineering](https://youtu.be/2p6Su4XD8yo); investigate education pathways and universities in Australia. * Demonstrate [how an LED works](https://youtu.be/Iwv5momDiKQ) (LED Light, coin cell battery); facilitate the [Helicopter LED circuit task](https://www.instructables.com/id/LED-Paper-Helicopter/) or [Instructables Craft Stick Candles](https://www.instructables.com/id/Craft-Stick-Candles/) activity. Activity could be expanded using one of the following CAD/CAM activities: * [TinkerCAD Glow Circuit](https://v1.tinkercad.com/things/glfRMjmKCay-glow-circuit-assembly/edit?lessonid=EW74NBCJ48POGA7&projectid=O2C1PXBIQ2KHCOD&collectionid=O2C1PXBIQ2KHCOD#/lesson-viewer) – 3D printed simple circuit activity. * [Thingiverse Candle Circuit](https://www.thingiverse.com/thing:34330) – laser cut simple circuit activity. * Discuss how electrical circuits work: * [Explaining an Electrical Circuit](https://youtu.be/VnnpLaKsqGU) * [Types of Electrical Circuits](https://youtu.be/RQ3djos_LY8) * [Electricity & Magnetism](https://www.youtube.com/playlist?list=PL8dPuuaLjXtN0ge7yDk_UA0ldZJdhwkoV) (Optional extension; could be assigned as homework) * Demonstrate how to construct simple circuits using one of the following options (students follow along with demonstrations working in groups of 3 – 4):   + [Chibitronics Basic Paper Circuit Kits](https://chibitronics.com/how-to-page/) (CHS Lending Library)   + [Squishy Circuits](https://www.makerspaces.com/squishy-circuits/)   + [SnapGuide Circuit Blocks](https://snapguide.com/guides/make-circuit-blocks/) * Introduce and demonstrate the [Makey Makey](https://youtu.be/wkPt9MYqDW0) & outline assessment task 2 (alternative equipment in Lending Library are Chibitronics, ShakeUp and Makeblock Neuron kits which perform similar functions):   + *Part 1:* Students follow along with demonstrations to complete simple circuit challenge tasks (helicopter, candle (craft / 3D Print / Laser Cut), Paper / Squishy / SnapGuide Block) activities   + *Part 2:* In groups of 3 – 4, students use the iSTEM process and Makey Makey (see alternate equipment choices if needed) to design an interactive signing wall with the following constraints:     1. concepts must be touch interactive and mountable on a vertical surface     2. use music to immerse user into a concept or story; students can create / record their own music, import. Use block-based coding to control interactive features (Scratch Programming)     3. conceal & secure wires and equipment from user view to prevent tampering or damage to project functionality     4. each group must have a unique theme or experience     5. projects can include conductive objects or low cost items such as garden plants, recycled materials, etc; if students are purchasing additional items, project expense should not exceed $15; projects can include CAD / CAM objects made at school.   **As a class**   * In pairs - research a chosen or allocated scientist from the history of electricity video; create a poster outlining achievements and biography details (this could be used as a guess who quiz activity with posters posted around the library with QR code to answer the quiz questions / identify the scientist). * In pairs - research electromechanical education and career pathways and share findings with the class. * In rotating groups of 3 or 4 – complete simple circuit challenges.   + Select group members for Part 2 of assessment task 2; begin brainstorming ideas & collecting materials for construction.   **Students**   * + Engage in class discussion and actively participate in group activities.   + Learn to use the Makey Makey (or alternative equipment) by completing a series of assigned tutorials (consider allowing students to check out or take home a Makey Makey).   + Apply self-directed learning skills to complete [Makey Makey](https://makeymakey.com/pages/how-to) Beginner Online Classes:      * + - Lesson 1: [Create a Simple Circuit](https://makeymakey.com/blogs/how-to-instructions/lesson-one-simple-circuit) (10 mins)     - Lesson 2: [Hands on a Makey Makey](https://makeymakey.com/blogs/how-to-instructions/lesson-two-hands-on-a-makey-makey) (20 mins)     - Lesson 3: [What is Conductive?](https://makeymakey.com/blogs/how-to-instructions/lesson-three-what-is-conductive) (30 mins)     - Lesson 4: [Draw a Playable Instrument](https://makeymakey.com/blogs/how-to-instructions/lesson-four-draw-a-playable-instrument) (30 mins)     - Lesson 5: [Code your Key Presses in Scratch](https://makeymakey.com/blogs/how-to-instructions/lesson-five-code-your-key-presses-in-scratch) (45 mins)     - Lesson 6: [Craft and Code Interactive Stories](https://makeymakey.com/blogs/how-to-instructions/lesson-six-interactive-story-city-diorama-or-poster) (45 mins) * Apply critical, creative thinking and cognitive flexibility skills to solve simple circuit challenges.   **Optional Adjustment**   * + Use Squishy or Paper Circuits to create light up and moving objects versus an interactive singing wall display.   + Groups are provided with a component of a shared theme ie: Mental Health (RU Okay) or Cultural Inclusivity (Sorry Day).   **Optional Extension**   * Students select a range of circuit equipment to create an individual extension project based on a passion topic. * Students create a SnapGuide circuit block set with at least 1 sensor and one output device. * Students construct and test a [Faraday Cage](https://backyardbrains.com/experiments/faraday). * Students construct and test a mini [Tesla Coil](https://www.youtube.com/watch?v=owbkvDW7wAQ). * Class investigation and debate: Tesla vs Edison. | * Students to describe the importance of design to meet human needs * Students articulate an understanding of: * simple circuit (types and function) * conductivity * impacts of electricity (past, current & future) * electromechanical career or study pathways * important scientist(s) contributions to electricity * requirements of Assessment task 2. * Students demonstrate the ability to use and follow a set of instructions (verbal, written and video). * Students apply self-directed learning skills to construct simple circuits. * Students actively, responsibly and respectfully participate in the collaborate discussion. * Students apply project management, self-directed learning and essential skills to meet deadlines. * Students test and modify simple circuit prototypes. * Students demonstrate creative problem-solving, critical thinking and cognitive flexibility in solving simple circuit challenges. |  |
| **Week 8 - 10**   * Apply the iSTEM process to refine design concepts and develop an interactive circuit prototype. * Demonstrate an understanding of safe operation of all STEM equipment. * Apply self-directed learning and project collaboration skills to design and produce a functional interactive prototype. * Apply block-based coding skills to control interactive prototype components. * Select appropriate materials and tools to produce a functional prototype. * Showcase an interactive project incorporating music and simple circuits. | **Teacher**   * Allocate or adjust groups based on observation of skills and participation. * Review requirements & constraints for assessment task 2 (see above). * Facilitate and monitor group work; advising adjustments or mentoring as needed. * Organise opportunities for students to work collaboratively outside classroom hours (code club in the library or SISP STEM Project Officer to run after school sessions for project mentoring). * Organise an end of term showcase or demonstration of student projects (this could be a display in the library, Primary school demonstration or a parent teacher night). ***TIP:*** *SISP STEM Project Officer support to coteach / facilitate Advanced Manufacturing Centre supervision and coordinate a project showcase would be advantageous.*   **Students – In Groups**   * In allocated groups of 3 or 4 – use the iSTEM process, scratch programming and Makey Makey to design an interactive singing wall experience for display in the library or showcased at a community event. * Use the iSTEM process as a guide to iteratively design a project prototype. * Complete assigned components of groupwork (coding, electrical wiring, music / story, construction / artwork). * Apply self-directed learning skills to design, test, modify and manufacture components for the interactive circuit prototype. * Demonstrate safe use of all STEM equipment. * Apply critical, creative thinking and cognitive flexibility skills to solve circuit prototype construction challenges. * Prepare the prototype display for an authentic audience.   **Optional Adjustment**   * Students to work individually to construct an interactive circuit prototype. * Students to create a set of SnapGrid circuit block.   **Optional Extension**   * Groups integrate more than one Makey Makey device into a themed walk-thru experience ie: Haunted House or Escape Room. | * Students demonstrate an understanding of the following within their finished prototype:   + - simple circuits to control interactive components     - iterative design in the creation of a prototype     - adherence to project constraints     - safe use of all STEM equipment.   + Students apply self-directed learning skills to construct assigned components of a group project or group role.   + Students apply project management, self-directed learning and essential skills to meet deadlines.   + Students demonstrate creative problem-solving, critical thinking and cognitive flexibility in solving prototype construction challenges. |  |

## 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 3D Cane Puppets – 8 iSTEM – Stage 4 Program

Summary

## Students will continue to develop project management skills, demonstrate a strong foundation of interconnected knowledge across Science, Technology, Engineering and Mathematics and expand their puppetry construction skills. In the Year 7 iSTEM program, students explored the basics of 2D puppets, in this unit students will expand their puppetry skills to collaboratively produce small scale 3D illuminated and articulated puppets similar to large festival performance puppets.

## In the 3D Cane Puppets unit, students will embark on their first major task to explore the world of cane puppets with learning guided by local Hunter entertainment artists, Curious Legends, in a series of custom designed videos and learning resources. Students will simulate the STEM team and project management skills by specialising in a specified area or skill to collaboratively complete a large scale project. This cross-curricular unit will also make connections to other Key Learning Areas, such as English, PDHPE, CAPA and HISE in a fun, creative project to highlight STEM skills in the entertainment Industry.

Duration

14 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** 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

Unit overview

Throughout the cane puppet task, students will explore the traditional and emerging skills behind the art, engineering and science of puppet making by mastering biomechanics and kinesiology movement of 3D puppets designs based on cultural or historical stories.

Students will apply science, technology, engineering and mathematics connections to the creations of cane puppets while practicing essential skills to collaboratively apply the iterative iSTEM process. By the end of the unit, students will have completed a design folio to showcase culturally or historically inspired designs and completed cross-curricular learning activities as they develop a 3D articulated puppet. 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 geometry, biomechanics, script writing, soldering and history related to performance puppetry, as well expanding previously developed biology knowledge (musculoskeletal structures), engineering construction techniques, 3D modelling skills, spatial drawing, electronics knowledge and computer programming skills.

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, cane, 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 Cane Puppet Student Work booklet & Videos
* LED strip lights, microcontroller boards (Arduino Uno, Microbit, Kookaberry, Circuit Playground, etc), breadboards, power sources, resistors, jumper cables, wire strippers, soldering iron, solder, Swan or 3rd arm, etc
  + - 1. Websites
* iTeachSTEM (in development; links available Term 3 2020)
* [STEM Industry in School Partnerships Program](https://sispprogram.schools.nsw.gov.au/) – Show Time unit supplementary resources (worksheets & videos)
* [Curious Legends](https://www.curiouslegends.com.au/) – puppet theatre company
* [Types of puppets](http://www.purplerock.org/puppetbuilding.htm) – Purple Rock Productions
* [The World of Puppetry](https://theworldofpuppetry.weebly.com/jim-henson.html) – Jim Henson & The Muppets
* The World of Puppetry: [Japanese Bunraku Puppets](https://theworldofpuppetry.weebly.com/japanese-bunraku-puppets.html), [Indonesian Wayang Golek Puppets](https://theworldofpuppetry.weebly.com/indonesian-wayang-golek-puppets.html), [European Puppets](https://theworldofpuppetry.weebly.com/european-puppets.html) & [Vietnamese Water Puppets](https://theworldofpuppetry.weebly.com/vietnamese-water-puppets.html)
* [How Muppets are Created](https://entertainment.howstuffworks.com/muppet.htm) – How Stuff Works
* [Puppetry Muppet Worksheet](https://www.scribd.com/doc/249890635/jim-henson#download&from_embed) – Scribd
* [Sample Puppetry Rubric](https://www.scribd.com/doc/251969136/final-puppet-rubric) – Scribd (Teacher Resource)
* [Using Wicker to Build Puppets](http://www.purplerock.org/wicker.htm) – Purple Rock Productions
* [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
* [Properties of Shapes](https://www.khanacademy.org/math/basic-geo/basic-geometry-shapes/basic-geo-properties-shapes/v/sides-corners) – Khan Academy Online Course
* [Geometric Solids: Counting faces & edges of 3D Shapes](https://www.khanacademy.org/math/basic-geo/basic-geometry-shapes/basic-geo-geometric-solids/v/counting-faces-and-edges-of-3d-shapes) – Khan Academy Online Course
* [Area & Perimeter of Composite Shapes](https://www.khanacademy.org/math/basic-geo/basic-geo-area-and-perimeter#area-trap-composite) – Khan Academy Online Course
* [The Musculoskeletal System](https://www.khanacademy.org/science/high-school-biology/hs-human-body-systems#hs-the-musculoskeletal-system) – Khan Academy Online Course
* [What is Skin?](https://www.sciencenewsforstudents.org/article/explainer-what-skin) – Explainer article for students
* [Dreamtime](https://dreamtime.net.au/dreaming/story-list/) – Aboriginal Dreamtime Stories
* [Dreamings](https://education.abc.net.au/home#!/search/%20Dreamtime) – ABC Education collection of Dreamtime Stories
* [Popular Aboriginal Dreamtime Stories](https://www.welcometocountry.org/aboriginal-dreamtime-stories/) – Welcome to Country
* [13 Delightful Children’s Stories from Around the World](https://theculturetrip.com/middle-east/iran/articles/13-delightful-childrens-stories-from-around-the-world/) – Culture Trip
* [World of Tales](https://www.worldoftales.com/#gsc.tab=0) – Cultural Folktales
* [World Stories](https://worldstories.org.uk/) – cultural stories in multiple languages
* [Intro to LED Strips](https://www.instructables.com/id/Intro-to-LED-Strips/) - Instructables
  + - 1. Videos
* [Legenden Vom Licht Performance](https://vimeo.com/287962289) – large scale puppet performance by Curious Legends
* [Penjelajahan Orangutan – constructing puppets](https://www.youtube.com/watch?v=M-UcRqRpqqo)
* [Penjelajahan Orngutan – Collaborative Theatre Show (Behind the Scenes)](https://www.youtube.com/watch?v=q-BcujPeMzA)
* [Penjelajahan Orangutan Grand Opening Palangka Raya](https://www.youtube.com/watch?v=RHKqygVqAlA)
* Show Time Cane Puppet - video series
* [Bohemian Rhapsody Parody Muppet Music Video](https://www.youtube.com/watch?v=tgbNymZ7vqY) – The Muppets
* [The Art of Puppetry & Marionettes](https://www.youtube.com/watch?v=8zqUprOVCC0) – SubCultures
* [Basic of Biomechanics](https://www.youtube.com/watch?v=r3-UuoQ6fbY) – Australian Coaches
* [What is skin?](https://www.youtube.com/watch?v=yKAzVC0WcmI) – Layers of Human Skin
* [Arduino LED Strip Lights (Breadboarding Into)](https://www.youtube.com/watch?v=Hn9KfJQWqgI) - Make
* [Soldering for Beginners: 5 Easy Steps](https://www.youtube.com/watch?v=Qps9woUGkvI)
* [How to Cut & Solder LED Strip Lights](https://www.youtube.com/watch?v=Ay4G6RasAek)

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| Content | Teaching and learning | Evidence of learning | Adjustments and registration |
| **Week 1 - 4**   * Investigate the history of 3D puppetry across multiple cultures. * Expand an understanding of the STEM skills and equipment used in puppetry design and performance. * Develop mathematical skills in geometry to identify 3D shape types and calculate area of composite shapes. * 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. * Use spatial drawing and 3D modelling to represent prototype concepts. | **Teacher**   * Introduce the unit by reviewing the iSTEM process (reference posters on the wall) and prior puppetry learning and ask prompting questions:   + What can you recall from the Year 7 shadow puppet unit?   + What other types of puppets do you know about?   + What are the differences (skills and materials needed) between 2D & 3D puppets?   + What are / identify some famous puppets? * Reinforce the importance of science and math knowledge / skills in the construction of puppets. * Direct students to learning materials on Google Drive; outline types of activities to be completed to support project construction (Curious Legend videos, worksheets and online Khan Academy tutorials for Math & Science learning). * Outline the goal of the unit: Collaboratively design a 3D articulated and illuminated cane puppet based on a cultural story.   **As a Class**   * Watch the following videos as a class and complete the associated activities:   + [Bohemian Rhapsody Parody Muppet Music Video](https://www.youtube.com/watch?v=tgbNymZ7vqY) – identify / recall the names of as many Muppets as possible (challenge).   + [Penjelajahan Orngutan – Collaborative Theatre Show (Behind the Scenes);](https://www.youtube.com/watch?v=q-BcujPeMzA) group discussion. What local or regional cultural stories could be used in a puppet performance in Cessnock?   + [Penjelajahan Orangutan – constructing puppets](https://www.youtube.com/watch?v=M-UcRqRpqqo); discussion. How does 2D & 3D puppet construction techniques differ and are similar?   + [Penjelajahan Orangutan Grand Opening Palangka Raya](https://www.youtube.com/watch?v=RHKqygVqAlA); discussion. What do you think the story in the performance is about? What performance techniques did the puppeteers use to convey messages? * Assign groups (4 – 5 students per group) based on student expertise, preference for roles, commitment to project work and ability levels to ensure teams and groups are well balanced for roles required. * Outline the requirements for assessment task 4 with the following constraints:   + design a 3D articulated and illuminated cane puppet based on a cultural story or theme and simulate realistic biomechanical movement   + each group must assign individuals to roles   + themes and designs must be approved by the teacher prior to beginning construction   + students to complete tutorials and activities associated with their assigned group role   + commitment outside class time may be required to complete puppets according to deadlines   + groups must conduct regular check-in with the classroom teacher to report on project progress and seek assistance where needed   + puppets must include articulated movement and automated lights to music appropriate to the cultural theme selected   + puppets cannot exceed 5 kilos in weight and must fit within a 90cm x 90cm x 90cm cube space; multiple puppets can be created but all puppets must holistically fit within the assigned space and weight requirements.   **Students**   * Engage in class discussion based on the videos to develop an understanding of 3D puppetry skills, history and equipment. * As an individual: Research the history of puppetry and create a slideshow comparison (5W & H, similarities and difference) of Muppets vs a chosen cultural puppet type and complete the [Puppetry Muppet Worksheet](https://www.scribd.com/doc/249890635/jim-henson#download&from_embed) (this could be assigned as homework or mid-term assessment task)   + [Types of puppets](http://www.purplerock.org/puppetbuilding.htm) – Purple Rock Productions   + [The World of Puppetry](https://theworldofpuppetry.weebly.com/jim-henson.html) – Jim Henson & The Muppets   + The World of Puppetry: [Japanese Bunraku Puppets](https://theworldofpuppetry.weebly.com/japanese-bunraku-puppets.html), [Indonesian Wayang Golek Puppets](https://theworldofpuppetry.weebly.com/indonesian-wayang-golek-puppets.html), [European Puppets](https://theworldofpuppetry.weebly.com/european-puppets.html) & [Vietnamese Water Puppets](https://theworldofpuppetry.weebly.com/vietnamese-water-puppets.html)   + [How Muppets are Created](https://entertainment.howstuffworks.com/muppet.htm) – How Stuff Works * In pairs (15 minutes at the start of a lesson) or assigned as homework, complete 1 Maths and 1 Science course from the following online tutorials:   + [Properties of Shapes](https://www.khanacademy.org/math/basic-geo/basic-geometry-shapes/basic-geo-properties-shapes/v/sides-corners)   + [Geometric Solids: Counting faces & edges of 3D Shapes](https://www.khanacademy.org/math/basic-geo/basic-geometry-shapes/basic-geo-geometric-solids/v/counting-faces-and-edges-of-3d-shapes)   + [Area & Perimeter of Composite Shapes](https://www.khanacademy.org/math/basic-geo/basic-geo-area-and-perimeter#area-trap-composite)   + [The Musculoskeletal System](https://www.khanacademy.org/science/high-school-biology/hs-human-body-systems#hs-the-musculoskeletal-system) * In groups of 4 -5 students begin the Show Time cane puppet or electronics activities associated with assigned roles. * As a group, create a project management timeline or GANTT chart (lucid charts or spreadsheet) and assign group roles (engineers for construction, performance specialists for script and cultural artistic representation in puppet appearance, project leader for management and documentation of iSTEM process & illumination designers for electronics and coding). * Collaboratively investigate and select a cultural theme for the group’s puppet performance:   + [Dreamtime](https://dreamtime.net.au/dreaming/story-list/) – Aboriginal Dreamtime Stories   + [Dreamings](https://education.abc.net.au/home#!/search/%20Dreamtime) – ABC Education collection of Dreamtime Stories   + [Popular Aboriginal Dreamtime Stories](https://www.welcometocountry.org/aboriginal-dreamtime-stories/) – Welcome to Country   + [13 Delightful Children’s Stories from Around the World](https://theculturetrip.com/middle-east/iran/articles/13-delightful-childrens-stories-from-around-the-world/) – Culture Trip   + [World of Tales](https://www.worldoftales.com/#gsc.tab=0) – Cultural Folktales   + [World Stories](https://worldstories.org.uk/) – cultural stories in multiple languages   **Optional Extension**   * Provide evidence of online tutorial completion for all the above listed maths and science base online tutorials. | * 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 of 3D puppetry and types of puppetry * cultural influences on puppet types and puppet performances. * Students demonstrate the ability to use and follow a set of video instructions to construct cane puppets. * Students select appropriate tools to record ideas. * Students investigate historically and culturally important puppets. * Students demonstrate collaboration and creative thinking in the design of cane puppets. |  |
| **Week 5 - 10 & Week 1 – 4 (Term 4)**   * Demonstrate an ability to following step-by-step tutorial instructions and apply self-directed learning skills in the completion of LED lighting control and cane puppet challenges. * Explore cultural stories. * Expand knowledge of musculoskeletal system to develop an understanding of biomechanics. * Work collaboratively to design a 3D illuminated and articulated puppet(s) used to tell a cultural story. * Apply the iSTEM process to design and develop puppet prototypes.      * Apply essential skills (communication, collaboration, creative problem-solving, critical thinking and cognitive flexibility) to plan, develop, rehearse and produce a culturally inspired cane puppet performance or dance. * 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. * Develop an understanding of LED light strips, breadboarding and soldering techniques. * Demonstrate an understanding of simulated biomechanics through puppet movement. * Apply computer programming skills to control illuminated puppet features. * Showcase puppet prototype for an authentic audience. | **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:* Introduction to Cane construction and project management   + *Activity 2:* Applied Geometry in Puppet design   + *Activity 3:* Simulating Biomechanical Movement   + *Activity 4:* Representing Culture in Puppet Design   + *Activity 5:* Bringing Puppets to Life. * Introduce tools and techniques for controlling illumination of puppets:   + [Intro to LED Strips](https://www.instructables.com/id/Intro-to-LED-Strips/)   + [Arduino LED Strip Lights (Breadboarding Into)](https://www.youtube.com/watch?v=Hn9KfJQWqgI)   + [Soldering for Beginners: 5 Easy Steps](https://www.youtube.com/watch?v=Qps9woUGkvI)   + [How to Cut & Solder LED Strip Lights](https://www.youtube.com/watch?v=Ay4G6RasAek) * Facilitate project work with regular check-ins for progress. * Adjust groups (4 – 5 students per group) based on student expertise, preference for roles, commitment to project work and ability levels to ensure teams and groups are well balanced for roles required.   **Students - Groups**   * As an individual, complete assigned tasks and complete associated tutorial learning to support project completion; watch and follow along with the Show Time cane puppet and LED / soldering videos to: * develop cane construction techniques to create shape and movement * assign group roles and apply project management techniques * use the iSTEM process to generate ideas and prototypes of culturally influenced puppet(s) * artistically represent cultural representation into the internal and external design of 3D puppets * integrate automated lighting using soldering, breadboarding, electronics and computer programming.   **Optional Adjustment**   * Based on ability, some students could focus on creating 2D props for performances in an assigned team. * Multiple groups working on the same theme (voted on as a class or teacher assigned) using multiple puppets to tell a story.   **Optional Extension**   * Construct multiple puppets or props to tell a story. * Construct a playdoh model of human skin (layers and parts). | * Students apply critical thinking skills to solve challenges related to light and shadow. * Students apply mathematical knowledge and skills to the design and construction of 3D articulated puppets. * Students use a variety of problem-solving and communication skills to biomechanical movement in 3D puppetry. * Students demonstrate safe and responsible use of all STEM equipment. * Students construct 3D cane puppet frames, joints and external coverings. * Students watch, read and interpret instructions. * Students apply essential skills, self-directed learning and project management skills to the completion of assigned role tasks and project work. * Students apply critical thinking skills to solve challenges related to electronics and computer coding (block-based or text-based) required to illuminate puppet designs. * Students use a variety of problem-solving and communication skills to convey a cultural story. * Students construct models and performances to demonstrate a practical understanding of engineering, mathematical and scientific principles. * Students watch, read and interpret instructions. * Students demonstrate the ability to work collaboratively and solve problems to produce a solution within set timeframes. * Student demonstrate safe and responsible use of all STEM equipment. * Students demonstrate an understanding of the iSTEM process in the construction of articulated puppet design. * Students seek and provide critical feedback to improve prototypes and performances. * Students demonstrate creativity and communication skills to showcase a puppet performance 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: Dance Bot – 8iSTEM – Stage 4 Program

Summary

Throughout Year 7 & 8 iSTEM courses, students have developed an understanding of STEM skills and applied engineering principles through a range of design challenges. In the Dance Bot unit, students will revisit skills in computer programming using a variety of tools from the Cessnock Academy of STEM Excellence Lending Library. Students will be encouraged to experiment with both block-based to text-based coding to celebrate the end Stage 4 with a collaborative designed dancing robotics performance. 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

6 weeks

Outcomes

**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

**2.2** *(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

**2.4** 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

Unit overview

In Dance Bot unit, students will continue to expand block-based coding skills and begin to experiment with text-based coding skills while using the robotic tools available in the Cessnock Academy of STEM Excellence Lending Library. Students will have a choice between using Tello Drones, Marty Robots and Sphero Mini robots as they creatively tackle the challenge of coded and synchronised movement. The collaboratively designed and choreographed dance performance will celebrate the end of Stage 4 iSTEM achievement.

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 pipe cleaners, scissors, rubber bands etc. (Marty Robot costume designs)
* Sphero Mini robotics sets (Lending Library) & Sphero Edu software
* Marty Robot sets (Lending Library) and software
* Tello Drone sets & [Tello Edu Software](https://play.google.com/store/apps/details?id=com.wistron.telloeduIN&hl=en_US)

Websites

* [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 3: Dance Party](https://martytherobot.com/wp-content/uploads/2019/01/marty-challenge-guide5.pdf) – activity instructions
* [Sphero Dance Party](https://edu.sphero.com/cwists/preview/65-dance-partyx) – activity instructions
* [Tello Drone EDU](https://www.ryzerobotics.com/tello-edu) - website

Videos

* [Sphero YouTube Channel](https://www.youtube.com/channel/UC5EJptL-l6f4tY6lRdLm_Sw) – tutorials
* [Tello Drone Swarm Dance](https://www.youtube.com/watch?time_continue=46&v=FVYxxHn8R-k&feature=emb_logo) – video
* [Sphero Thriller Dance](https://www.youtube.com/watch?v=6Ub7z9y1Gbs) – video
* [Marty Hip to Be Square Dance](https://youtu.be/27HYoSyMDNk) – video

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| Content | Teaching and learning | Evidence of learning | Adjustments and registration |
| **Week 5 – 10 (Term 4)**   * Expand computer programming skills using robotics. * Apply block-based computer programming skills and explore text-based programming to solve a range of practical challenges. * Demonstrate an ability to work collaboratively to plan, design, test and deploy synchronised robotic and drone movements. * Apply self-directed learning skills in the completion of coding challenges. | **Teacher**   * Introduce the unit by highlighting some of their impressive achievements (discussion: what are they most proud of or learned the most doing) throughout Year 7 & 8 iSTEM; explain that their next challenge will be to celebrate the end of Stage 4 through the synchronised dancing of robotic performances. Show the following videos to drum up inspiration:   + [Tello Drone Swarm Dance](https://www.youtube.com/watch?time_continue=46&v=FVYxxHn8R-k&feature=emb_logo)   + [Sphero Thriller Dance](https://www.youtube.com/watch?v=6Ub7z9y1Gbs)   + [Marty Hip to Be Square Dance](https://youtu.be/27HYoSyMDNk) * Outline the challenge expectations:   + students will be split into 4 teams (drones, Marty Bots, Sphero Bots, performance management / costumes / music); students can nominate their preference for teams with teacher allocating groups based on observation of student skills and interests   + all robots must perform together but also have a solo segment; ie: a mashup of the example videos above   + music and themes selected must be appropriate for school use   + performance should last between 1 – 2 minutes   + all robotic functions must be coded using block-based or text-based coding skills   + ***TIP:*** *SISP STEM Project Officer support to coteach and coordinate an authentic audience would be advantageous.*   **As a class**   * Brainstorm and vote on a theme for the dance performance including choice of music; teacher may provide some options to choose from to prevent students spending too much time on this activity. * Split into teams to design a 30 second routine (could be split into 2 teams of 15 seconds each for the same robot type) associated with their assigned robot (Tello Drone, Marty or Sphero Mini); The project management team will design a 20 second synchronised routine for all bots to complete along with robot costumes or props for the performance. * Rehearse, test and modify routines as needed; this could be expanded to computer coding club during break times or after school.   **Students**   * Engage in class discussion and idea generation. * Contribute actively to assigned group coding activities using block-based or text-based coding and problem solving skills. * Work collaboratively and respectfully using self-directed learning to complete assigned group duties. * Apply critical, creative thinking and cognitive flexibility skills to solve coding challenges and project problems. * Participate in the performance for an authentic audience.   **Optional Extension**   * Students dance along side robots in the performance to complete the duration of the chosen song. | * Students demonstrate the ability to use and follow a set of instructions. * Students apply self-directed learning skills to create synchronised robotic movement. * Students actively, responsibly and respectfully participate in the collaborate design a robotic dance routine. * Students apply project management, self-directed learning and essential skills to meet deadlines. * Students showcase their work to authentic audience. * Students demonstrate creative problem-solving, critical thinking and cognitive flexibility in finding, detecting and correcting computer coding errors. |  |

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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