

CURRICULUM RESOURCE MODULE

**Template**

YEAR 3 TO YEAR 6

**Acknowledgements**

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*Kidblog, Weebly, Evernote (should be in all Yr 7 to 12 modules as part of Appendix 5.)*

*Autodesk, Tinkercad, SketchUp (if Appendix 4B is present)*

**The table of contents will build itself. Simply right click and "update field**".

Table of contents

[The STEM Learning Project 2](#_Toc37285424)

[Developing a STEM curriculum resource module 3](#_Toc37285425)

[Instructions on using the CRM template 4](#_Toc37285426)

[Overview 5](#_Toc37285427)

[Activity sequence and purpose 8](#_Toc37285428)

[Background 9](#_Toc37285429)

[Activity 1: Title 11](#_Toc37285430)

[Activity 2: Title 13](#_Toc37285431)

[Activity 3: Title 15](#_Toc37285432)

[Activity 4: Title 17](#_Toc37285433)

[Appendix 1: Links to the Western Australian Curriculum 19](#_Toc37285434)

[Appendix 1B: Mathematics proficiency strands 23](#_Toc37285435)

[Appendix 2: General capabilities continuums 24](#_Toc37285436)

[Appendix 3: Materials list 27](#_Toc37285437)

[Appendix 4: Design process guide 28](#_Toc37285438)

[Appendix 5: Reflective journal 29](#_Toc37285439)

[Appendix 6: Student activity sheet 1.0: Journal checklist 30](#_Toc37285440)

[Appendix 7: Teacher resource sheet 1.1: Cooperative learning – Roles 31](#_Toc37285441)

[Appendix 8: Teacher resource sheet 1.2: Cooperative learning – Think-pair-share 32](#_Toc37285442)

[Appendix 9: Teacher resource sheet 1.3: Cooperative learning – Pass it on 33](#_Toc37285443)

[Appendix 10: Teacher resource sheet 1.4: Cooperative learning – Inside-outside 34](#_Toc37285444)

[Appendix 11: Teacher resource sheet 1.5: Cooperative learning – Silent card sort 35](#_Toc37285445)

[Appendix 12: Student activity sheet 1.6: I see, I think, I wonder 36](#_Toc37285446)

[Appendix XX: Teacher resource sheet X.X: Construction skills 37](#_Toc37285447)

[Appendix XX: Student activity sheet X.X: Prototype troubleshooting 42](#_Toc37285448)

[Appendix XX: Student activity sheet XX: Analysis 43](#_Toc37285449)

[Appendix XX: Student activity sheet XX: Analysis 44](#_Toc37285450)

[Appendix XX: Teacher resource sheet XX: Evaluation 45](#_Toc37285451)

[Appendix XX: Teacher resource sheet XX: 3 – 2 – 1 Reflection 46](#_Toc37285452)

# The STEM Learning Project

The aim of the STEM Learning Project is to generate students’ interest, enjoyment and engagement with STEM (Science, Technology, Engineering and Mathematics) and to encourage their ongoing participation in STEM both at school and in subsequent careers. The curriculum resources will support teachers to implement and extend the Western Australian Curriculum and develop the general capabilities across Kindergarten to Year 12.

**Why STEM?**

A quality STEM education will develop the knowledge and intellectual skills to drive the innovation required to address global economic, social and environmental challenges.

STEM capability is the key to navigating the employment landscape changed by globalisation and digital disruption. Routine manual and cognitive jobs are in decline whilst non-routine cognitive jobs are growing strongly in Australia. Seventy-five per cent of the jobs in the emerging economy will require critical and creative thinking and problem solving, supported by skills of collaboration, teamwork and literacy in mathematics, science and technology. This is what we call STEM capability. The vision is to respond to the challenges of today and tomorrow by preparing students for a world that requires multidisciplinary STEM thinking and capability.

**The approach**

STEM capabilities are developed when students are challenged to solve open-ended, real-world problems that engage students in the processes of the STEM disciplines.

STEM Consortium



# Developing a STEM curriculum resource module

A STEM learning module should encourage learning that is student-led and teacher-facilitated, and have an open-ended problem-solving approach. Problem solving involves an intellectual struggle that provides opportunities for higher-order thinking, reasoning and creativity.

**Steps to designing an effective CRM**

1. Consider the elements and pedagogy the module should include, such as:

* A problem-based learning pedagogy
* A real-world problem in an authentic context
* STEM learning area content
* Suitability for learners
* The [*Design process*](#_Appendix_4:_Design)
* Opportunities, where possible, to use and develop ICT skills
* Opportunities for developing higher order thinking, collaborative learning skills and reflective practice.

1. Consider the Western Australian Curriculum

Review the year level curriculum content descriptions from each of the Science, Technology and Mathematics learning areas. Consider students previous learning.

Identify opportunities for students to develop the general capabilities and cross-curriculum priorities.

1. Develop a clear theme and the driving question you would like students to solve.

Consider current real-world problems both globally and locally. Review the [*United Nations Sustainable Development Goals*](https://www.un.org/sustainabledevelopment/sustainable-development-goals/) for inspiration. Think about the big issues for Western Australia.

Consolidate the real-world problem down to the context of the students: How does this problem relate to important issues for the local community, students in your classroom or families at your school?

1. Develop an outline for each of the *Activities*

* *Activity 1* – Research

What and how will the students research to develop their understandings of the problem? How will their prior knowledge be drawn upon?

Students can research aspects of any or all of the learning areas.

* *Activity 2* – Investigate

What investigations will students carry out to understand the variables that impact upon the problem?

* *Activity 3* – Imagine and create

How will students enagae with the process strands of the learning areas and the design process to ideate their solutions?

* *Activity 4* – Evaluate and communicate

How will students pitch their solutions? How could industry or other authentic audienes be involved?

# Instructions on using the CRM template

When working with the template it is helpful to do the following things each time the document is opened:

* The green text and the ### symbols are either instructions or examples and should be replaced as you develop your CRM.
* It may be useful to have a copy of an existing module as an example of how a module looks and what it contains.

**Year X – Module title**

# Overview

|  |
| --- |
| A general overarching view of the module:  **What is the context?**  ###State the context in relation to the year level of the student.  **What is the problem?**  State the problem the students will be solving? |
| **How does this module support integration of the STEM disciplines?**  **Science**  Describe how the Western Australian Curriculum: Science is integrated into this module. How are the content descriptions related to the activtities in which the students will participate? What will the students learn?  **Technology**  Describe how the Western Australian Curriculum: Technologies is integrated into this module. How are the content descriptions related to the activtities in which the students will participate? What will the students learn?  The [Design process guide](#_Appendix_4:_Design) is included as a resource to provide assistance to teachers in understanding the complete design process as developed in the Technologies syllabus.  **Mathematics**  Describe how the Western Australian Curriculum: Mathematics is integrated into this module. How are the content descriptions related to the activtities in which the students will participate? What will the students learn?  **General capabilities**  There are opportunities for the development of general capabilities and cross-curriculum priorities as students engage with *module title*. In this module, students:   * Develop critical and creative thinking skills as they research the problem and its context (*Activity 1*); investigate parameters impacting on the problem (*Activity 2*); imagine and develop solutions (*Activity 3*); and evaluate and communicate their solutions to an audience (*Activity 4*). * Utilise creative thinking as they generate possible design solutions; and critical thinking, numeracy skills and ethical understanding as they choose between alternative approaches to solving the problem of …………... * Utilise personal and social capability as they develop socially cohesive and effective working teams; collaborate in generating solutions; adopt group roles; and reflect on their group work capabilities through self and peer evaluation. * Utilise a range of literacies and information and communication technology (ICT) capabilities as they collate records of work completed throughout the module in a journal; represent and communicate their solutions to an audience using digital technologies in *Activity 4.* * Communicate and, using evidence, justify their group’s design to an authentic audience that might include………………………………………... |
| **What are the pedagogical principles of the STEM learning modules?**  The STEM Learning Project modules develop STEM capabilities by challenging students to solve real-world problems set in authentic contexts. The problems engage students in the STEM disciplines and provide opportunities for developing higher order thinking and reasoning, and the general capabilities of creativity, critical thinking, communication and collaboration.  The design of the modules is based on four pedagogical principles:   * Problem-based learning   All modules are designed around students solving an open-ended, real-world problem. Learning is supported through a four-phase instructional model: research the problem and its context; investigate the parameters impacting on the problem; design and develop solutions to the problem; and evaluate and communicate solutions to an authentic audience.   * Developing higher order thinking   The question mark symbol Opportunities are created for higher order thinking and reasoning through questioning and discourse that elicits students' thinking, prompts and scaffolds explanations, and requires students to justify their claims. Opportunities for making reasoning visible through discourse are highlighted in the modules with the icon shown here.   * Collaborative learning   This provides opportunities for students to develop teamwork and leadership skills, challenge each other’s ideas, and co-construct explanations and solutions. Information that can support teachers with aspects of collaborative learning is included in the resource sheets.   * Reflective practice   Recording observations, ideas and one’s reflections on the learning experiences in some form of journal fosters deeper engagement and metacognitive awareness of what is being learnt. Information that can support teachers with journaling is included in the resource sheets.  These pedagogical principles can be explored further in the STEM Learning Project online professional learning modules located in Connect Resources. |

# Activity sequence and purpose

|  |  |
| --- | --- |
| Activity 1 Research  The Activity 1 icon consists of a magnifying glass. | Activity title  Activity 1 focus. One or two sentences that summarise the main aspects of the Activity. |
| Activity 2 Investigate Icon  The Activity 2 icon consists of images of maths equipment and a beaker to represent investigation. The Activity 2 icon consists of images of maths equipment, a beaker, and a light bulb to represent design. \\alderaan\redirected$\Mark.OBrien\Desktop\Images\Icons\Act 2 Investigate.jpg | **Activity title**  Activity 2 focus. One or two sentences that summarise the main aspects of the Activity. |
| Activity 3 Imagine and Create  The Activity 3 icon consists of a light bulb representing imagine, design and create. | **Activity title**  Activity 3 focus. One or two sentences that summarise the main aspects of the Activity. |
| Activity 4 Evaluate and Communicate  The Activity 4 icon consists of a megaphone to represent the communication part of the process. | **Activity title**  Activity 4 focus. One or two sentences that summarise the main aspects of the Activity. |

# Background

|  |  |
| --- | --- |
| **Expected learning** | Summarise the curriculum content and expected learning. Write these as learning outcomes.  These should also be included in Appendix 1.  Students will be able to: |
| **Vocabulary** | The specific vocabulary of the module can be captured here or listed in a resource sheet in the appendices.  This module uses subject-specific terminology, some of which is shown in *Teacher resource sheet #.#: title title.*  The following vocabulary list contains other terms that need to be understood, either before the module commences or developed as they are used. |
| **Timing** | There is no prescribed duration for this module. The module is designed to be flexible enough for teachers to adapt. Activities do not equate to lessons; one activity may require more than one lesson to implement. |
| **Consumable materials** | The specific materials required for this module that are not ordinarily found in your classroom can be captured here or listed in a resource sheet in the appendices.  A [Materials list](#_Appendix_3:_Materials) is provided for this module. The list outlines materials outside of normal classroom equipment that will be needed to complete the activities. |
| **Safety notes** | There are potential hazards inherent in these activities and with the equipment being used, and a plan to mitigate any risks will be required.  Potential hazards specific to this module include but are not limited to:   * + - * Possible exposure to cyber bullying, privacy violations and uninvited solicitations when using the internet |
| **Enterprise skills** | The *#########* module focuses on higher order skills, with significant emphasis on outcomes from the general capabilities and enterprise skills.  Enterprise skills include problem solving, communication skills, digital literacy, teamwork, critical thinking and presentation skills.  Further background is available from the Foundation for Young Australians in the *New Work Order* six report series. A summary can be found at: [www.fya.org.au/report/new-work-order-summary](https://www.fya.org.au/report/new-work-order-summary/) |
| **Assessment** | The STEM modules have been developed to provide students with learning experiences to solve authentic real-world problems using science, technology, engineering and mathematics capabilities. While working through the module, the following assessment opportunities will arise:   * List potential assessment opportunities here.   [Appendix 1](#_Appendix_1:_Curriculum)indicates how the activities are linked to the Western Australian Curriculum.  Evidence of learning from journaling, presentations and anecdotal notes from this module can contribute towards the larger body of evidence gathered throughout a teaching period and can be used to make on-balance judgements about the quality of learning demonstrated by the students in the science, technologies and mathematics learning areas.  Students can further develop the general capabilities of Information and communication technology capability, Critical and creative thinking, and Personal and social capability. Continuums for these are included in the [General capabilities continuums](#_Appendix_2:_General_1) but are not intended to be for assessment purposes. |

# Activity 1: Title

|  |  |
| --- | --- |
| **Activity 1 Research  The Activity 1 icon consists of a magnifying glass.Activity focus** | One or two sentences that summarise the main aspects of the Activity. |
| **Background information** | Information the teacher may find useful prior to implementing the lesson.  The purpose is to provide teachers with comprehensive information to reduce the need to research areas outside their subject area expertise. |
| **Instructional procedures** | Procedures to assist in the successful implementation of the activity. For example, visualisation strategies, cooperative learning strategies, inquiry based instructional strategies, differentiation, use of technology, higher order thinking and reasoning questions, modelling of classroom discourse and behaviour management strategies. |
| **Expected learning** | Summarise the curriculum content and expected learning. Write these as learning outcomes.  These should also be included in Appendix 1  Students will be able to: |
| **Equipment required** | **For the class:** |
| **For the students**: |
| **Preparation** | List any tasks or equipment that needs to be organised prior to the start of the Activity. |
| **Activity parts** | Decide on the individual tasks students will complete and describe them here.  Include some well considered, open questions.  **Part 1: ###** |
| **Part 2: ###** |
| **Part 3: ###** |
| **Part 4: ###** |
| **Part 5: Reflection / journaling** |
| **Resource sheets** | List resource sheets you develop here. |
| **Digital resources** | Provide links to websites with information to enhance learning. |
|  |
|  |
|  |
| **Literary resources** | Provide links to relevant literary resources. |
|  |
|  |
|  |

# Activity 2: Title

|  |  |
| --- | --- |
| **Activity focus**  Activity 2 Investigate Icon  The Activity 2 icon consists of images of maths equipment and a beaker to represent investigation. | One or two sentences that summarise the main aspects of the Activity. |
| **Background information** | Information the teacher may find useful prior to implementing the lesson.  The purpose is to provide teachers with comprehensive information to reduce the need to research areas outside their subject area expertise. |
| **Instructional procedures** | Procedures to assist in the successful implementation of the activity. For example, visualisation strategies, cooperative learning strategies, inquiry based instructional strategies, differentiation, use of technology, higher order thinking and reasoning questions, modelling of classroom discourse and behaviour management strategies. |
| **Expected learning** | Summarise the curriculum content and expected learning. Write these as learning outcomes.  These should also be included in Appendix 1  Students will be able to:  1.  2.  3. |
| **Equipment required** | **For the class:** |
| **For the students**: |
| **Preparation** | List any tasks or equipment that needs to be organised prior to the start of the Activity. |
| **Activity parts** | Decide on the individual tasks students will complete and describe them here.  Include some well considered, open questions.  **Part 1: ###** |
| **Part 2: ###** |
| **Part 3: ###** |
| **Part 4: ###** |
| **Part 5: ### Reflection / journaling** |
| **Resource sheets** | List resource sheets you develop here. |
| **Digital resources** | Provide links to websites with information to enhance learning. |
|  |
|  |
|  |
| **Literary resources** | Provide links to relevant literary resources. |
|  |
|  |
|  |

# Activity 3: Title

|  |  |
| --- | --- |
| **Activity 3 Imagine and Create  The Activity 3 icon consists of a light bulb representing imagine, design and create.Activity focus** | One or two sentences that summarise the main aspects of the Activity. |
| **Background information** | Information the teacher may find useful prior to implementing the lesson.  The purpose is to provide teachers with comprehensive information to reduce the need to research areas outside their subject area expertise. |
| **Instructional procedures** | Procedures to assist in the successful implementation of the activity. For example, visualisation strategies, cooperative learning strategies, inquiry based instructional strategies, differentiation, use of technology, higher order thinking and reasoning questions, modelling of classroom discourse and behaviour management strategies. |
| **Expected learning** | Summarise the curriculum content and expected learning. Write these as learning outcomes.  These should also be included in Appendix 1  Students will be able to:  1.  2.  3. |
| **Equipment required** | **For the class:** |
| **For the students**: |
| **Preparation** | List any tasks or equipment that needs to be organised prior to the start of the Activity. |
| **Activity parts** | Decide on the individual tasks students will complete and describe them here.  Include some well considered, open questions.  **Part 1: ###** |
| **Part 2: ###** |
| **Part 3: ###** |
| **Part 4: ###** |
| **Part 5: ### Reflection / journaling** |
| **Resource sheets** | List resource sheets you develop here. |
| **Digital resources** | Provide links to websites with information to enhance learning. |
|  |
|  |
|  |
| **Literary resources** | Provide links to relevant literary resources. |
|  |
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|  |

# Activity 4: Title

|  |  |
| --- | --- |
| **Activity focusActivity 4 Evaluate and Communicate  The Activity 4 icon consists of a megaphone to represent the communication part of the process.** | One or two sentences that summarise the main aspects of the Activity. |
| **Background information** | Information the teacher may find useful prior to implementing the lesson.  The purpose is to provide teachers with comprehensive information to reduce the need to research areas outside their subject area expertise. |
| **Instructional procedures** | Procedures to assist in the successful implementation of the activity. For example, visualisation strategies, cooperative learning strategies, inquiry based instructional strategies, differentiation, use of technology, higher order thinking and reasoning questions, modelling of classroom discourse and behaviour management strategies. |
| **Expected learning** | Summarise the curriculum content and expected learning. Write these as learning outcomes.  These should also be included in Appendix 1  Students will be able to:  1.  2.  3. |
| **Equipment required** | **For the class:** |
| **For the students**: |
| **Preparation** | List any tasks or equipment that needs to be organised prior to the start of the Activity. |
| **Activity parts** | Decide on the individual tasks students will complete and describe them here.  Include some well considered, open questions.  **Part 1: ###** |
| **Part 2: ###** |
| **Part 3: ###** |
| **Part 4: ###** |
| **Part 5: ### Reflection / journaling** |
| **Resource sheets** | List resource sheets you develop here. |
| **Digital resources** | Provide links to websites with information to enhance learning. |
|  |
|  |
|  |
| **Literary resources** | Provide links to relevant literary resources. |
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|  |

# Appendix 1: Links to the Western Australian Curriculum

The *XXXX* module provides opportunities for developing students’ knowledge and understandings in science, technologies and mathematics. The table below shows how this module aligns to the content of the Western Australian Curriculum and can be used by teachers for planning and monitoring.

Delete sections and add content descriptions as required.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Module title**  Links to the Western Australian Curriculum | ACTIVITY | | | |
| **1** | **2** | **3** | **4** |
| **SCIENCE** |  |  |  |  |
| SCIENCE UNDERSTANDING |  |  |  |  |
| Biological sciences: |  |  |  |  |
| Chemical sciences: |  |  |  |  |
| Earth and space sciences: |  |  |  |  |
| Physical sciences: |  |  |  |  |
| SCIENCE AS A HUMAN ENDEAVOUR |  |  |  |  |
| Nature and development of science: |  |  |  |  |
| Use and influence of science: |  |  |  |  |
| SCIENCE INQUIRY SKILLS |  |  |  |  |
| Questioning and predicting: |  |  |  |  |
| Planning and conducting: |  |  |  |  |
| Processing and alalysing data and information: |  |  |  |  |
| Evaluating: |  |  |  |  |
| Communicating: |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| **Module title**  Links to the Western Australian Curriculum | ACTIVITY | | | |
| **1** | **2** | **3** | **4** |
| **DESIGN AND TECHNOLOGIES** |  |  |  |  |
| KNOWLEDGE AND UNDERSTANDING |  |  |  |  |
| Technologies and society: |  |  |  |  |
| Technologies contexts: Engineering principles and systems |  |  |  |  |
| Technologies contexts: Food and Fibre production |  |  |  |  |
| Technologies contexts: Materials and technologies specialistaions |  |  |  |  |
| PROCESSES AND PRODUCTION SKILLS |  |  |  |  |
| Creating solutions by: Investigating and defining: |  |  |  |  |
| Creating solutions by: Designing |  |  |  |  |
| Creating solutions by: Producing and implementing |  |  |  |  |
| Creating solutions by: Evaluating |  |  |  |  |
| Creating solutions by: Collaborating and managing |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| **Module title**  Links to the Western Australian Curriculum | ACTIVITY | | | |
| **1** | **2** | **3** | **4** |
| **DIGITAL TECHNOLOGIES** |  |  |  |  |
| KNOWLEDGE AND UNDERSTANDING |  |  |  |  |
| Digital systems: |  |  |  |  |
| Representation of data: |  |  |  |  |
| PROCESSES AND PRODUCTION SKILLS |  |  |  |  |
| Collecting, managing and analysing data: |  |  |  |  |
| Digital implementation: |  |  |  |  |
| Creating solutions by: Investigating and defining |  |  |  |  |
| Creating solutions by: Designing |  |  |  |  |
| Creating solutions by: Producing and implementing |  |  |  |  |
| Creating solutions by: Evaluating |  |  |  |  |
| Creating solutions by: Collaborating and managing |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| **Module title**  Links to the Western Australian Curriculum | ACTIVITY | | | |
| **1** | **2** | **3** | **4** |
| **MATHEMATICS** |  |  |  |  |
| NUMBER AND ALGEBRA |  |  |  |  |
| Number and place value: |  |  |  |  |
| Fractions and decimals: |  |  |  |  |
| Money and financial mathematics: |  |  |  |  |
| Patterns and algebra: |  |  |  |  |
| MEASUREMENT AND GEOMETRY |  |  |  |  |
| Using units of measurement: |  |  |  |  |
| Shape: |  |  |  |  |
| Location and transformation: |  |  |  |  |
| STATISTICS AND PROBABILITY |  |  |  |  |
| Chance: |  |  |  |  |
| Data representation and interpretation: |  |  |  |  |

Further information about assessment and reporting in the Western Australian Curriculum can be found at: [k10outline.scsa.wa.edu.au/home](https://k10outline.scsa.wa.edu.au/home).

# Appendix 1B: Mathematics proficiency strands

**Key ideas**

In Mathematics, the key ideas are the proficiency strands of understanding, fluency, problem-solving and reasoning. The proficiency strands describe the actions in which students can engage when learning and using the content. While not all proficiency strands apply to every content description, they indicate the breadth of mathematical actions that teachers can emphasise.

**Understanding**

Students build a robust knowledge of adaptable and transferable mathematical concepts. They make connections between related concepts and progressively apply the familiar to develop new ideas. They develop an understanding of the relationship between the ‘why’ and the ‘how’ of mathematics. Students build understanding when they connect related ideas, when they represent concepts in different ways, when they identify commonalities and differences between aspects of content, when they describe their thinking mathematically and when they interpret mathematical information.

**Fluency**

Students develop skills in choosing appropriate procedures; carrying out procedures flexibly, accurately, efficiently and appropriately; and recalling factual knowledge and concepts readily. Students are fluent when they calculate answers efficiently, when they recognise robust ways of answering questions, when they choose appropriate methods and approximations, when they recall definitions and regularly use facts, and when they can manipulate expressions and equations to find solutions.

**Problem-solving**

Students develop the ability to make choices, interpret, formulate, model and investigate problem situations, and communicate solutions effectively. Students formulate and solve problems when they use mathematics to represent unfamiliar or meaningful situations, when they design investigations and plan their approaches, when they apply their existing strategies to seek solutions, and when they verify that their answers are reasonable.

**Reasoning**

Students develop an increasingly sophisticated capacity for logical thought and actions, such as analysing, proving, evaluating, explaining, inferring, justifying and generalising. Students are reasoning mathematically when they explain their thinking, when they deduce and justify strategies used and conclusions reached, when they adapt the known to the unknown, when they transfer learning from one context to another, when they prove that something is true or false, and when they compare and contrast related ideas and explain their choices.

Source:

[www.australiancurriculum.edu.au/f-10-curriculum/mathematics/key-ideas/?searchTerm=key+ideas#dimension-content](https://www.australiancurriculum.edu.au/f-10-curriculum/mathematics/key-ideas/?searchTerm=key+ideas%23dimension-content%20)

# Appendix 2: General capabilities continuums

The general capabilities continuums shown here are designed to enable teachers to understand the progression students should make with reference to each of the elements. There is no intention for them to be used for assessment.

**Information and communication technology (ICT) capability learning continuum**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sub-element** | **Typically by the end of Foundation Year** | **Typically by the end of Year 2** | **Typically by the end of Year 4** |
| **Create with ICT**  **Generate ideas, plans and processes** | use ICT to follow or contribute to a simple plan for a solution | use ICT to prepare simple plans to find solutions or answers to questions | use ICT to generate ideas and plan solutions |
| **Create with ICT**  **Generate solutions to challenges and learning area tasks** | use ICT as a creative tool to generate simple solutions, modifications or data representations for personal or school purposes | experiment with ICT as a creative tool to generate simple solutions, modifications or data representations for particular audiences or purposes | create and modify simple digital solutions, creative outputs or data representation/ transformation for particular purposes |
| **Communicating with ICT**  **Collaborate, share and exchange** | use purposefully selected ICT tools safely to view information shared by trusted adults | use purposefully selected ICT tools safely to share and exchange information with appropriate local audiences | use appropriate ICT tools safely to share and exchange information with appropriate known audiences |

**Critical and creative thinking learning continuum**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sub-element** | **Typically by the end of Foundation Year** | **Typically by the end of Year 2** | **Typically by the end of Year 4** |
| **Inquiring – identifying, exploring and organising information and ideas**  **Organise and process information** | gather similar information or depictions from given sources | organise information based on similar or relevant ideas from several sources | collect, compare and categorise facts and opinions found in a widening range of sources |
| **Generating ideas, possibilities and actions**  **Imagine possibilities and connect ideas** | use imagination to view or create things in new ways and connect two things that seem different | build on what they know to create ideas and possibilities in ways that are new to them | expand on known ideas to create new and imaginative combinations |
| **Generating ideas, possibilities and actions**  **Seek solutions and put ideas into action** | predict what might happen in a given situation and when putting ideas into action | investigate options and predict possible outcomes when putting ideas into action | experiment with a range of options when seeking solutions and putting ideas into action |
| **Reflecting on thinking and processes**  **Transfer knowledge into new contexts** | connect information from one setting to another | use information from a previous experience to inform a new idea | transfer and apply information in one setting to enrich another |

**Personal and social capability learning continuum**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sub-element** | **Typically by the end of Foundation Year** | **Typically by the end of Year 2** | **Typically by the end of Year 4** |
| **Social management**  **Work collaboratively** | share experiences of cooperation in play and group activities | identify cooperative behaviours in a range of group activities | describe characteristics of cooperative behaviour and identify evidence of these in group activities |
| **Social management**  **Negotiate and resolve conflict** | listen to others’ ideas, and recognise that others may see things differently from them | practise solving simple interpersonal problems, recognising there are many ways to solve conflict | identify a range of conflict resolution strategies to negotiate positive outcomes to problems |
| **Social management**  **Develop leadership skills** | identify ways to take responsibility for familiar tasks at home and school | discuss ways in which they can take responsibility for their own actions | discuss the concept of leadership and identify situations where it is appropriate to adopt this role |

Further information about general capabilities is available at:

[k10outline.scsa.wa.edu.au/home/p-10-curriculum/general-capabilities-over/general-capabilities-overview/general-capabilities-in-the-australian-curriculum](https://k10outline.scsa.wa.edu.au/home/p-10-curriculum/general-capabilities-over/general-capabilities-overview/general-capabilities-in-the-australian-curriculum)

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# Appendix 3: Materials list

The following materials are required to complete this module.

Materials for optional or extension parts are identified separately.

# Appendix 4: Design process guide

**Safe production of the final design or multiple copies of the final design**.

Fine tuning the production process, such as division of labour for batch or mass production.

Use of intended materials and appropriate tools to safely make the solution to the design problem.

**Reflection on the process taken and the success of the design.**

Evaluation can lead to further development or improvement of the design and can be a final stage of the design process before a conclusion is reached.

Could be formal or informal and verbal or written.

**Ideation**

**Development**

**Development of the design ideas. Improvements, refinements, adding detail, making it better.**

Activities such as detailed drawings, modelling, prototyping, market research, gaining feedback from intended user, further research – if needed – to solve an issue with the design, testing different tools or equipment, trialling production processes, measuring or working out dimensions, testing of prototypes and further refinement.

**Idea generation – turning ideas into tangible forms so they can be organised, ordered and communicated to others.**

Activities such as brainstorming, mind mapping, sketching, drawing diagrams and plans, collecting colour samples and/or material samples and talking through these ideas can help to generate fu creative ideas.

Using the **SCAMPER** model can assist with this: [www.mindtools.com/pages/article/newCT\_02.htm](http://www.mindtools.com/pages/article/newCT_02.htm)

[www.designorate.com/a-guide-to-the-scamper-technique-for- creative-thinking](http://www.designorate.com/a-guide-to-the-scamper-technique-for-creative-thinking)

**Analysis**

**Finding useful and helpful information about the design problem.**

Gathering information, conducting surveys, finding examples of existing solutions, testing properties of materials, practical testing.

**Understanding the meaning of the research findings.**

Analysing what the information means, summarising the surveys, judging the value of existing solutions, understanding test results.

**Research**

**Production**

**Evaluation**

# Appendix 5: Reflective journal

When students reflect on learning and analyse their own ideas and feelings, they self-evaluate, thereby improving their metacognitive skills. When students self‑monitor or reflect, the most powerful learning happens.

istockphoto.com

Journaling may take the form of a written or digital journal, a portfolio or a digital portfolio. Early childhood classrooms may use a class reflective floor book with pictures of the learning experience and scribed conversations.

Teachers can model the journaling process by thinking aloud and showing students how they can express learning and thoughts in a variety of ways including diagrams, pictures and writing.

A journal is a useful tool that gives teachers additional insight into how students value their own learning and progress, as well as demonstrating their individual achievements.

The following links provide background information and useful apps for journaling.

|  |
| --- |
| Kidblog – digital portfolios and blogging  [*kidblog.org/home*](https://kidblog.org/home) |
| Edmodo – for consolidating and storing class notes and learning materials  [*www.edmodo.com/*](https://www.edmodo.com/) |
| Explain Everything™ – a screen casting, video and presentation tool all in one  [explaineverything.com](https://explaineverything.com) |
| Popplet – allows you to jot down your ideas and then sort them visually  [Popplet.com](http://popplet.com/) |
| Seesaw – for capturing work completed by students in class, using a device’s camera function  [web.seesaw.me](https://web.seesaw.me) |
| Connect – the Department of Education’s integrated, online environment  [connect.det.wa.edu.au](http://connect.det.wa.edu.au) |
| Evernote (a digital portfolio app)  [evernote.com](https://evernote.com/) |
| *Digital portfolios for students* (Cool tools for school)  [cooltoolsforschool.wordpress.com/digital-student-portfolios](https://cooltoolsforschool.wordpress.com/digital-student-portfolios/) |

# Appendix 6: Student activity sheet 1.0: Journal checklist

Journal checklist

Photograph of a student completing a checklist.As an ongoing part of this module, you have been keeping a journal of your work.

Before submitting your journal to your teacher please ensure you have included the following information.

* Tick each box once complete and included.
* Write N/A for items that were not required in this module.

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|  |  |
| --- | --- |
| Your name and group member's names or photographs |  |
| An explanation of the problem you are solving |  |
| Your notes from *Activity 1* |  |
| Your notes from *Activity 2* |  |
| Your notes from *Activity 3* |  |
| Your notes from *Activity 4* |  |
| *Student activity sheet #.#: #############* |  |
| *Student activity sheet #.#: #############* |  |
| *Student activity sheet #.#: #############* |  |
|  |  |
| *Student activity sheet 1.0: Journal checklist* |  |

# Appendix 7: Teacher resource sheet 1.1: Cooperative learning – Roles

Cooperative learning

Photograph of four students working together at a table.Cooperative learning frameworks create opportunities for groups of students to work together, generally to a single purpose.

istockphoto.com

As well as having the potential to increase learning for all students involved, using these frameworks can help students develop personal and social capability.

When students are working in groups, positive interdependence can be fostered by assigning roles to group members.

These roles could include:

* working roles such as Reader, Writer, Summariser, Timekeeper
* social roles such as Encourager, Observer, Noise monitor, Energiser.

Teachers using the *Primary Connections* roles of Director, Manager and Speaker for their science teaching may find it effective to also use these roles for STEM learning.

Further to this, specific roles can be delineated for specific activities that the group is completing.

It can help students if some background to the purpose of group roles is made clear to them before they start, but at no time should the roles get in the way of the learning. Teachers should decide when or where roles are appropriate to given tasks.

**Cooperative learning

Photograph of five students looking at a problem together around a table.**

istockphoto.com

# Appendix 8: Teacher resource sheet 1.2: Cooperative learning – Think-pair-share

Cooperative learning frameworks create opportunities for groups of students to work together, generally to a single purpose.

istockphoto.com

As well as having the potential to increase learning for all students involved, using these frameworks can help students develop personal and social capability.

The think-pair-share strategy increases student participation and provides an environment for higher levels of thinking and questioning.

In the 'think' stage, each student thinks silently about a question asked by the teacher.

In the 'pair' stage, students discuss their thoughts and answers to the question in pairs.

In the 'share' stage, students share their answer, their partners answer or what they decided together. This sharing may be with other pairs or with the whole class. It is important also to let students 'pass'. This is a key element of making the strategy safe for students.



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# Appendix 9: Teacher resource sheet 1.3: Cooperative learning – Pass it on

Cooperative learning allows students to exchange ideas, thoughts or responses with each other, rather than with the teacher. It can generate new avenues of learning and multiple interactions with others can amplify student learning.

Cooperative learning

Photograph of students and teacher working together on a document‘Pass it on’ is a brainstorming activity that starts with groups of four students, or however many can fit around a large sheet of paper and record ideas.

Gettyimages.com

The groups are spread around the room in a circular shape. Each group has a large sheet of paper on which a nominated group leader writes the brainstorm topic or phrase in the middle.

The students have one minute to start recording ideas about the topic or phrase. When the minute has passed, each group leader takes their sheet to the neighbouring group, working in a clockwise direction.

Student groups, now with a new brainstorm paper, have 30 seconds to read it followed by 30 seconds to add something new, as exposure to new ideas can inspire more new ideas.

When that minute has passed, group leaders again must take their sheet to the neighbouring group to their left. Once again, students have 30 seconds to read, followed by 30 seconds to write.

Students continue this pattern until the sheets have completed a rotation to every group, or the sheets have no more space.

Following the activity, the teacher facilitates a class discussion by asking:

* What were the favourite ideas you read?
* What were the favourite ideas you recorded?
* What are the ideas you came up with after reading others’ ideas?
* Why do you think new ideas generate more new ideas?

The activity works well when students are motivated by the time limits; however, when conducting it for the first time, students may benefit with longer than one minute to learn the activity.

# Appendix 10: Teacher resource sheet 1.4: Cooperative learning – Inside-outside

Cooperative learning allows students to exchange ideas, thoughts or responses with each other, rather than with the teacher. It can generate new avenues of learning and multiple interactions with others can amplify student learning.

Cooperative learning

Photograph of five students together in a circle. The inside-outside strategy involves setting up the class into two halves.

Students in the first half stand and form a tight circle, with each student facing outwards.

Students in the second half form a circle outside the first circle, with each student standing to face a student from the inside circle.

Gettyimages.com.au

The teacher poses a question that asks for a response (eg *What types of animals have you seen around our school? What do you think they eat? And, where do you think they find it?*).

Students respond to the question by taking turns sharing their ideas and listening to their ‘face partner’. After 30 seconds or an appropriate amount of time, the teacher instructs students to pause.

Students in the outside circle rotate two steps to the left (so their new partner isn’t the neighbour who they may have just overheard). The new face partners exchange responses/ideas to the same teacher question.

After roughly seven rotations, the outside circle moves just one step to the left, and then returns to two step rotations to achieve interaction between every possible face partner combination.

Follow the activity, the teacher facilitates a class discussion by asking:

* What things did others tell you?
* How many new things did you learn?
* What were the most interesting things?
* What things do you want to know more about?

Content generated from this activity can feed into ongoing teaching and learning.

# Appendix 11: Teacher resource sheet 1.5: Cooperative learning – Silent card sort

Cooperative learning.

Photo of four students working together around a table. Cooperative learning frameworks create opportunities for groups of students to work together, generally for a single purpose.

As well as having the potential to increase learning for all students involved, using these frameworks can help students develop personal and social capability.

To engage in a silent card sort, students should be in groups of three or four students.

Groups are provided with a set of cards that need to be sorted into two or more given categories. In the initial phase, students must not speak at all. They silently use their fingers to move the cards around, all at the same time, cooperating and coordinating their actions without using any words or sounds.

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When most have completed the sort, the teacher gives the signal to begin talking and students then explain to each other their actions and negotiate any changes group members think necessary.

This activity provides for equal engagement from all in the group during the silent card sort, without any one person using language to take control of the activity. It requires cooperation and initial consensus through the movement of the cards alone. Students often use body language to convey meaning requiring attention to visual rather than aural cues.

When given the opportunity to talk, the participant then can justify and present arguments for any changes and gain final consensus through discussion.

# Appendix 12: Student activity sheet 1.6: I see, I think, I wonder

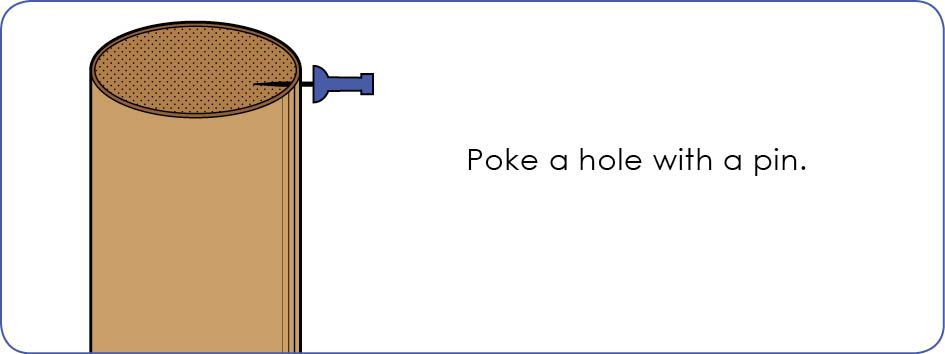
|  |
| --- |
| Eye graphicWhat do you see when you look at this image?  Pixabay.com |
| Light bulb graphicWhat are you thinking about as you look at this image?  Pixabay.com |
| Question graphicWhat are your wonderings (questions)?  Pixabay.com |

Information about the *I see, I think, I wonder* cooperative strategy can be found at: <http://pz.harvard.edu/resources/see-think-wonder-at>

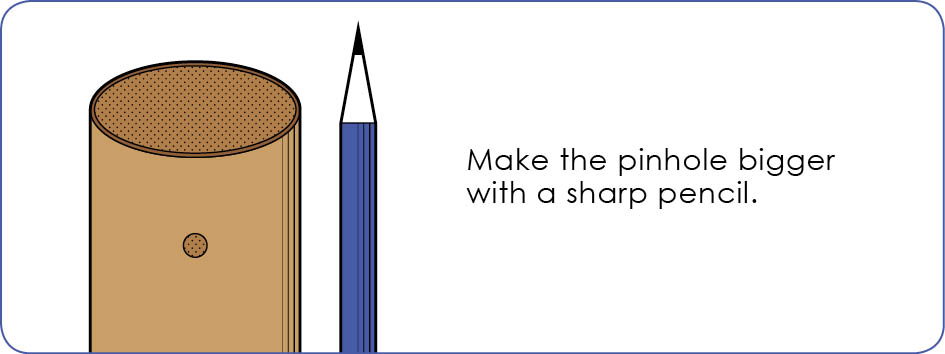
# Appendix XX: Teacher resource sheet X.X: Construction skills

Construction skills help students to generate and produce solutions for real-world problems.

This resource can be used as a visual stimulus to prompt students to develop solutions to design problems. The cards can be printed to create stations.

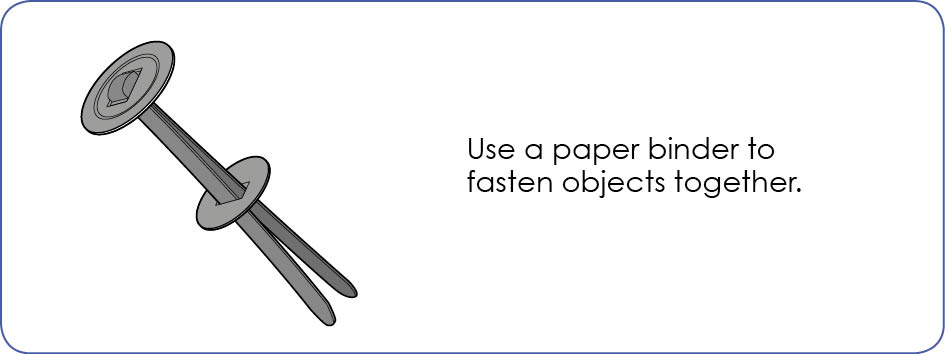


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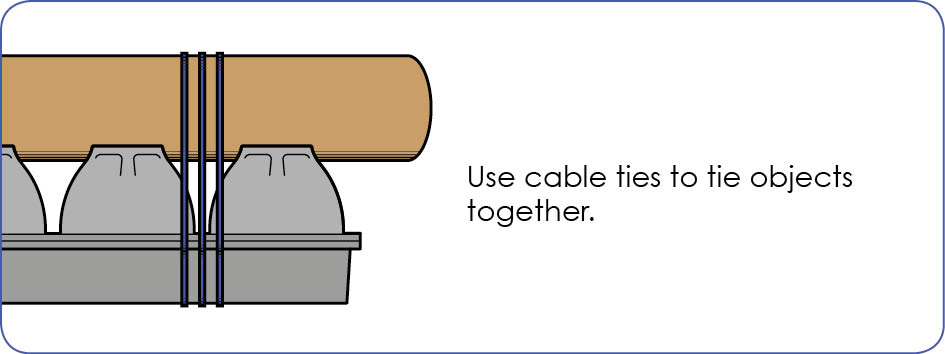
Poke a hole with a pin.

Construction skill

Graphic of a pipe cleaner passed through the hole in the tube and looped.

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Construction skill

Graphic of a piece of tape made into a loop with the outside being sticky. 

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Construction skill

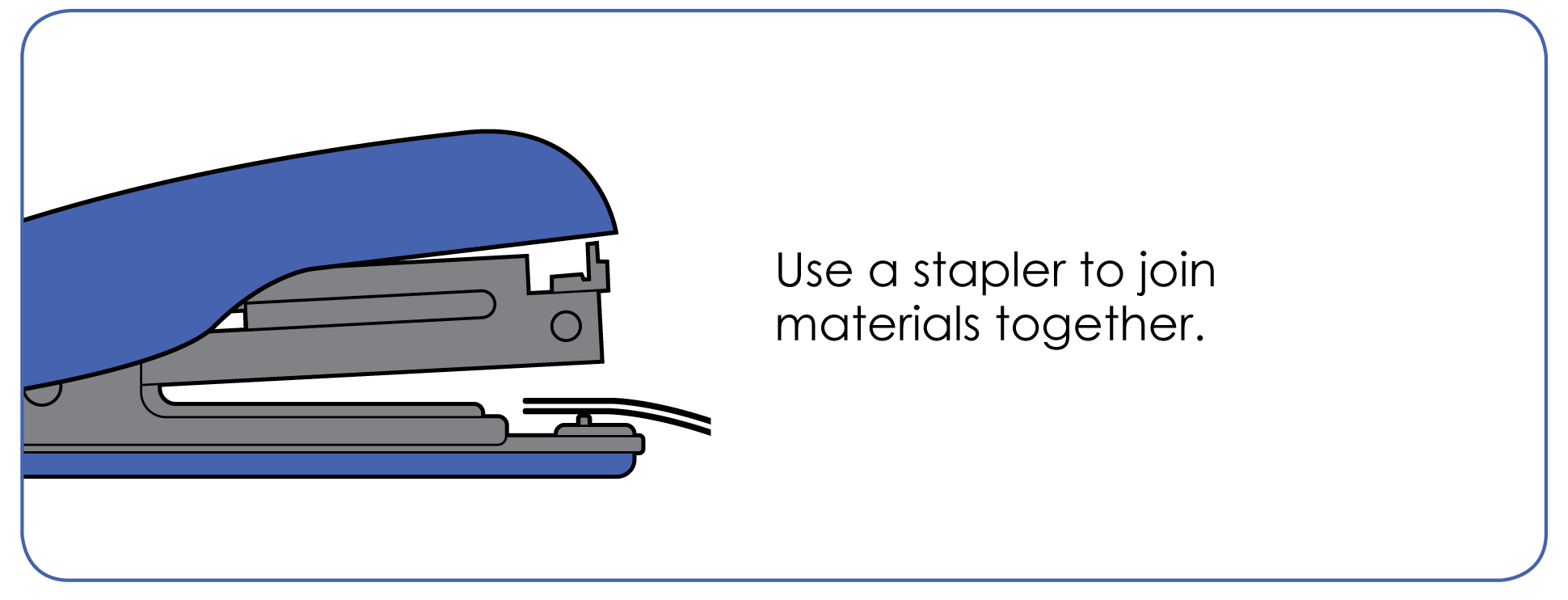
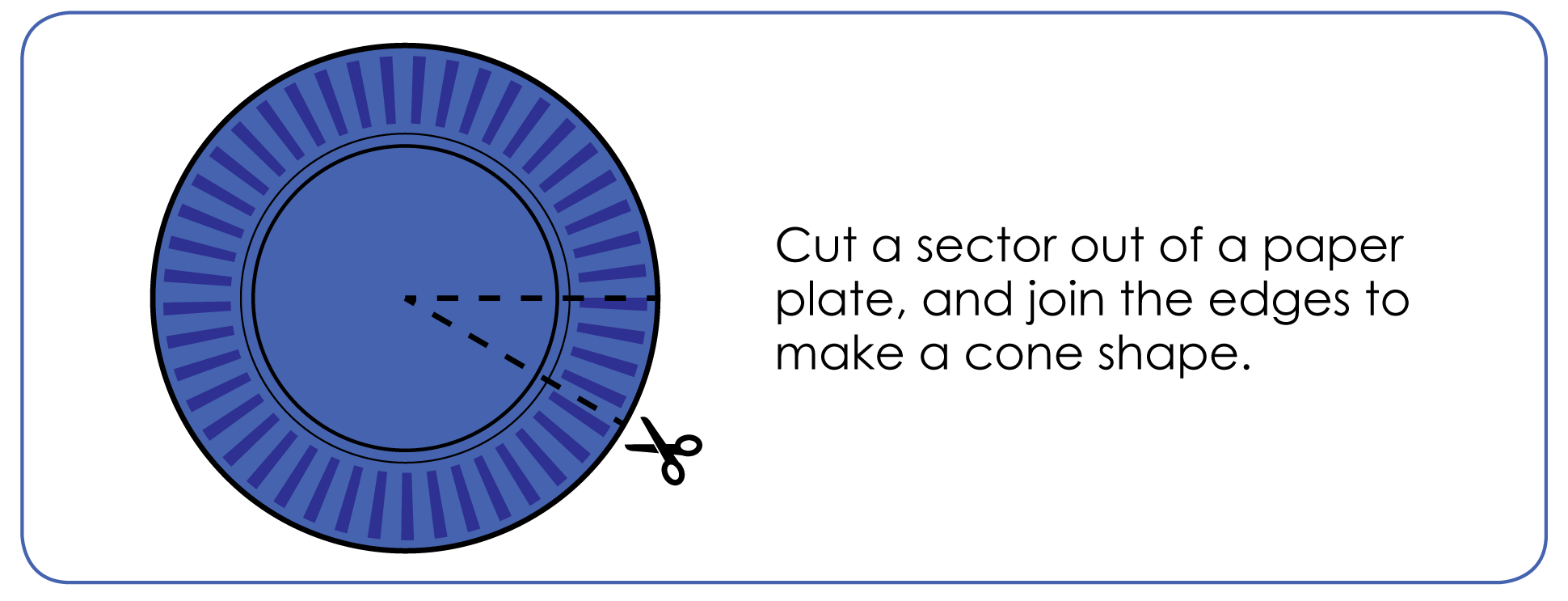
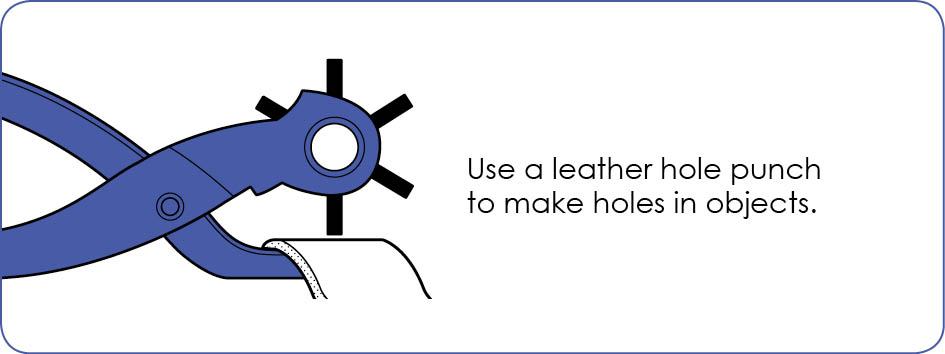
Graphic of a cardboard tube cut parallel to the tube so that the tube pieces can be folded flat and attached to a flat surface.

STEM Consortium

Construction skill

Graphic of a velcro for joining two objects.

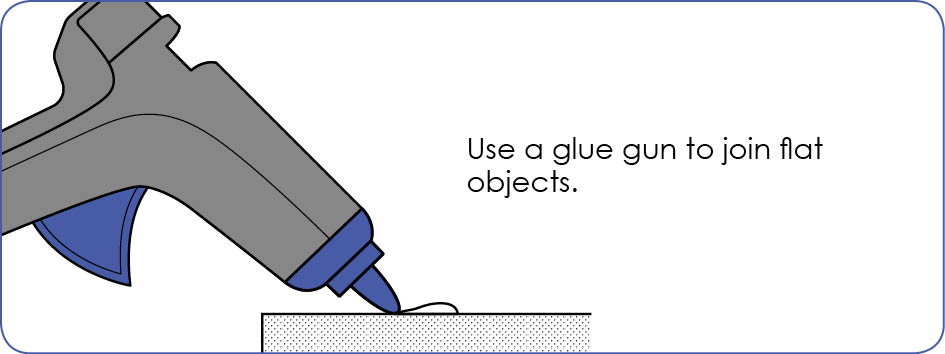
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# Appendix XX: Student activity sheet X.X: Prototype troubleshooting

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| --- | --- | --- |
| **Problem** | **Reason for the problem** | **Possible changes to your design to solve the problem** |
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# Appendix XX: Student activity sheet XX: Analysis

Write the steps you took to make your XXX.

What is it?

What does it do?

Is it different to your plan? How?

What is it made from?

# Appendix XX: Student activity sheet XX: Analysis

Draw or glue a picture of your XXX

# Appendix XX: Teacher resource sheet XX: Evaluation

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Key:   1. Sometimes 2. Consistently 3. Independently and consistently | Student name | | | | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Remains focused on tasks presented |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Completes set tasks to best of their ability |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Works independently without disrupting others |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Manages time effectively |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Cooperates effectively within the group |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Contributes to group discussions |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Shows respect and consideration for others |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Uses appropriate conflict resolution skills |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Actively seeks and uses feedback |  |  |  |  |  |  |  |  |  |  |  |  |  |

# Appendix XX: Teacher resource sheet XX: 3 – 2 – 1 Reflection

|  |  |  |  |
| --- | --- | --- | --- |
| **3 – 2 – 1 Reflection** | | | |
| **Name** | **3 things I learned** | **2 things I found interesting** | **1 thing I found difficult** |
|  |  |  |  |
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# Notes

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