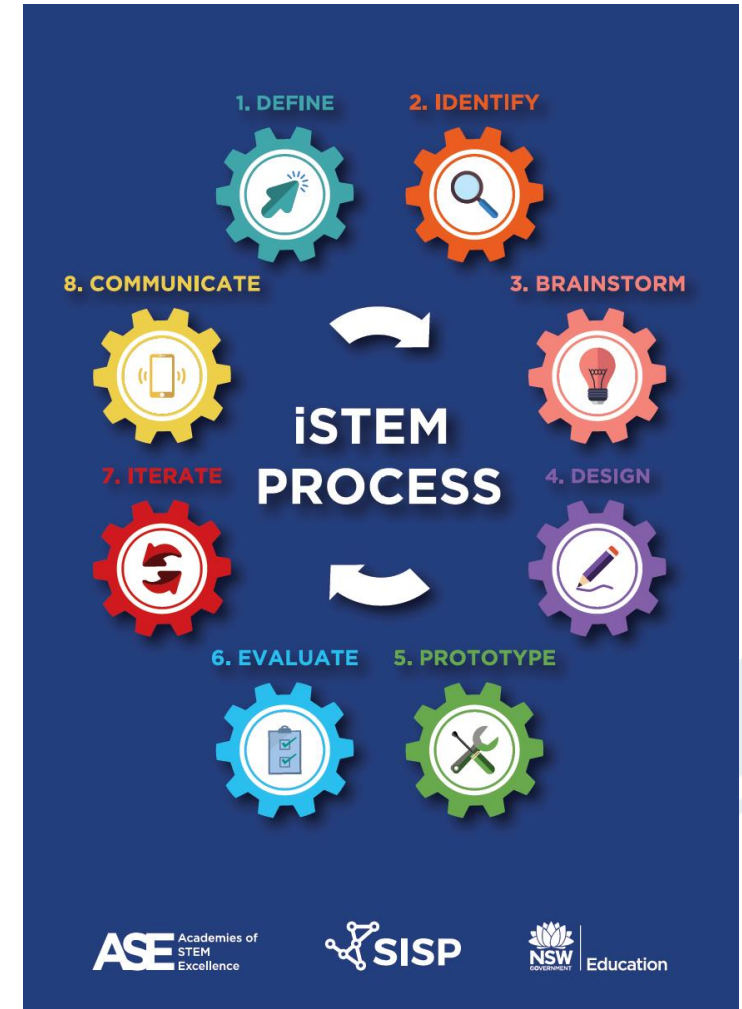
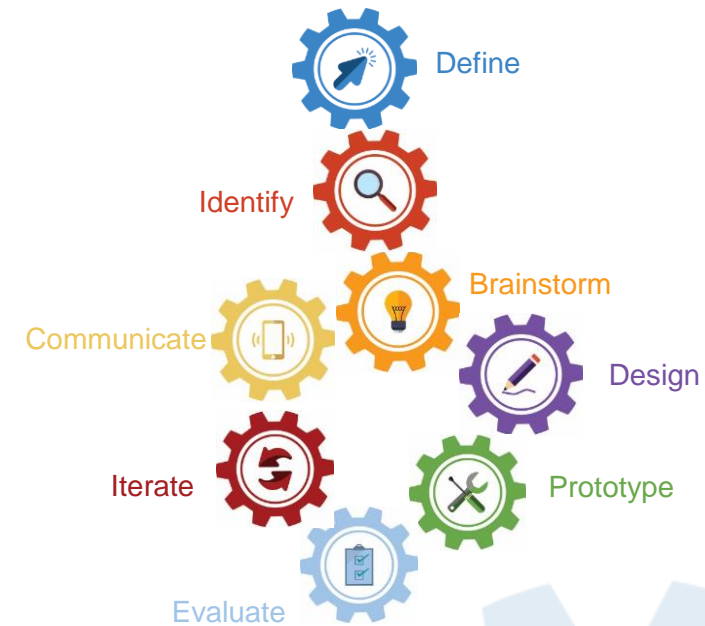
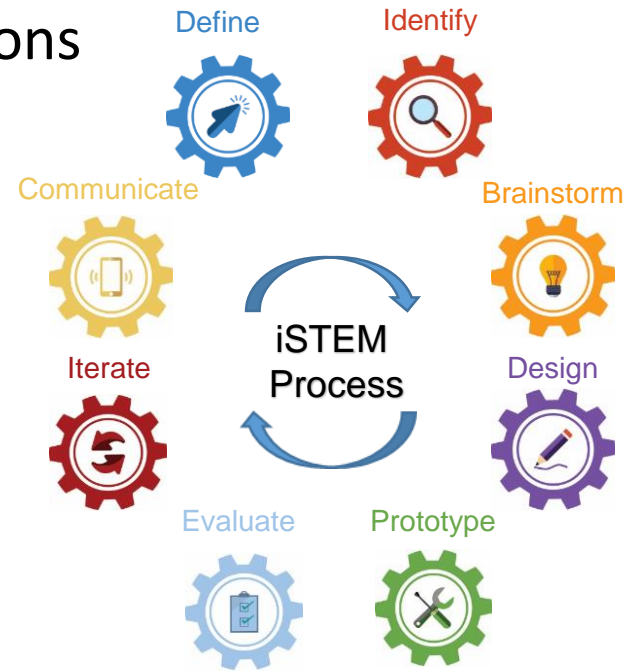


# iSTEM ENGINEERING DESIGN PROCESS



# 8 STAGES OF THE iSTEM PROCESS

1. **Define** – the problem
2. **Identify** – the constraints
3. **Brainstorm** – possible solutions
4. **Design** – your solution
5. **Prototype** – your solution
6. **Evaluate** – your solution
7. **Iterate** – your solution
8. **Communicate** – your solution



# 1. Define

## The Problem

*Describe the problem or need in detail to gain understanding. Think about and discuss initial thoughts.*

### Key Questions

- Why does the problem need to be resolved?
- What experiences can you relate to the problem?
- What caused the issue to begin with?
- What are your initial thoughts of how you could possibly resolve the issue?
- How can you help contribute to the solution?
- Do you have more questions about the problem?
- Who would benefit from finding a result?
- What process will need to occur to achieve the end result?
- Where do you start to resolve the problem?

### Possible Actions

- Mind map initial thoughts and additional questions
- Generate discussion about prior knowledge and experience
- Collaborative discussion on what assets are available
- Discuss resources available/needed to assist
- Define the actual problem clearly and concisely
- Identify sources of information
- Articulate the scope and nature of the problem
- Produce a statement of the problem



# 2. Identify

## The Constraints

*Outline the specific boundaries for which the project will be confined.*

### Key Questions

- How much will it cost and overall budget?
- What knowledge will be required to solve the problem?
- What skills are needed?
- Time for completion?
- Tools and equipment required and available?
- Scope of the final task?
- What data or information is required?
- What are the aesthetic, functional and ergonomic considerations?
- What are the features that must be included within the solution?
- Have all limitations been identified?

### Possible Actions

- Research constraints
- Meet with client to determine customer needs
- List all relevant constraints
- Produce a high level budget plan
- Produce a resource list, including tools, materials and people
- Identify start and finish dates for the project
- Identify what data and information will need to be collected
- Research the problem and potential solutions
- Produce matrix identifying the aesthetic, functional, ergonomic consideration



# 3. Brainstorm

## Multiple Solutions

*Discuss, expand and scaffold ideas collaboratively.*

### Key Questions

- Expand on initial understanding 'Define' ideas and 'Constraint' categories
- What categories are relevant to research?
- Identify and analyse data and additional information needed to build knowledge?
- What are existing solutions and thoughts of improved solutions?
- Expand priorities and constraints that must be included within the solution
- How will skills be implemented?
- How can technology be applied?
- Are the opportunities to reflect on quality and application throughout the process?

### Possible Actions

- Use a range of brainstorming techniques to produce ideas on developing solutions
- Produce a range of thumbnail sketches and annotated drawings
- Combine ideas to create new ideas
- Research existing solutions and design ideas
- Complete a skills audit
- Research possible technologies and techniques
- Add to mind map ideas
- Attempt to refine and simplify ideas relevant to 'Design'
- Expand on knowledge and solutions, take most relevant ideas to research



# 4. Design

## The Most Promising Solution

*Investigate areas which can provide a variety of options. Refine ideas down to one viable solution, create a plan to communicate ideas and process to resolve the problem.*

### Key Questions

- What the final product will be - concept/prototype/functional product/presentation/research task?
- What existing solutions can be evaluated?
- Refine and investigate key categories from 'brainstorm'
- What is the planned direction and priorities?
- Has a budget been considered?
- What technological skills are needed?
- What materials are available or needed for the task?
- What tools and skills are needed to complete the task?
- Are sizes, ergonomics, aesthetics a consideration?
- What skills are available or needed to ensure success?
- Estimated timeline and actions for management

### Possible Actions

- Identify priorities and goals to 'Prototype' the task
- Timeline of project to completion and/or process checklist
- Outline and allocate roles and responsibilities
- Analyse potential solutions and refine ideas
- Establish baseline data
- Identify resources available/needed to assist
- Define the 'best possible solution' to 'Prototype'
- Refer to 'brainstormed' ideas and provide scaffolding and regular feedback
- Produce detailed drawings of solutions/algorithms, flowcharts



# 5. Prototype

## Your Solution

*Produce a model of the best possible solution from 'Design' stage. This stage may call for areas within the plan to be revised.*



### Key Questions

- Do you have an adequate plan in place and are you prepared to begin the creation phase?
- Do all stakeholders know their roles and responsibilities?
- Can the final choices be justified?
- What type of prototype: product, mathematical, computer.
- Are there opportunities to reflect on quality?
- Is time management being effectively applied?
- WHS processes for practical tasks?
- Are resources available to execute the task effectively?  
Technology/materials/skills.
- What processes will need to be evaluated?
- What testing of the prototype is going to be required?

### Possible Actions

- Execution of areas identified to be completed
- Use rapid prototyping techniques to produce models of potential solutions
- Produce working models that demonstrate the aesthetics, functions and ergonomic attributes of the potential final solution
- Provide regular feedback to clients on progress
- Test each model against working criteria and goals
- Test for functionality and performance
- Compare and evaluate results from testing to determine which, if any, of the possible solutions will be implemented.
- If none of the solutions are ideal, return to stage 3 or 4

# 6. Evaluate

## And Test Your Solution

*Evaluate the solution against the identified problem in 'Define'.*

### Key Questions

- Was the plan followed?
- Has the solution resolved the problem as defined?
- Does it resolve the problem?
- Where can revisions/improvements be made?
- Will the revisions significantly improve the solution?
- How long will it take for the revisions to be made?
- Will the revisions be costly either time or financially?
- Are there resources available to achieve improvements?
- Is there more research and testing required?
- Where could improvements be made in the earlier stages?

### Possible Actions

- Critically reflect and evaluate the solution to the initial problem, plan and baseline data
- Client evaluations and feedback to establish if the solution is successful
- Self reflection from the design team to evaluate the process and improvements to be made
- Plan revisions if they are needed for the final product
- Plan improvements for the final solution
- Design team to provide regular feedback to client
- Re-evaluate, investigate, test and brainstorm until the solution resolves the problem effectively
- Update detailed drawings required for the production of the final product





# 7. Iterate

## To Improve Your Solution

*Evaluate the solution against the identified problem in 'Define'. Produce solution, revise and continually improve. May require starting back at earlier phases.*

### Key Questions

- How can the solution still meet the identified need?
- Has the identified problem changed?
- Are there other opportunities?
- How can the solution be improved?
- What are the consequences of not iterating?
- Do we need to revisit earlier phases of the process?
- What will the revisions look like? Are there plans?
- What needs to be completed?
- What are the priorities?
- How much time is needed to manage the revisions?
- Will the revisions remain within the budget?
- What new skills or additional resources will be required?

### Possible Actions

- Refine ideas based on results of experimentation and testing
- Prototype the final product, system or environment?
- Redesign solution, moving back through the process if required
- Analysis in reference to plan and baseline data
- Continual cycle from 'Design, Prototype and Evaluate' until the 'best possible solution' is found
- React to the results of evaluation
- All key stakeholders should agree on the proposed product, system or environment.
- Produce the final product? Minimal Viable Product level or production level



# 8. Communicate

## And Share Your Solution

*Share and communicate the solution.*

### Key Questions

- Have all key stakeholders been informed throughout the process?
- Who do you need to share the solution with?
- Would it benefit the broader market?
- How can you share the solution effectively?
- Have all the product specifications been documented?
- Have you received all regulatory approvals?
- Have all necessary reports been provided?
- What are the results of product testing?

### Possible Actions

- Pitch the solution to client or potential investors
- Document the design specifications, measurements and communicate to all groups
- Communicate between key stakeholders in meetings, presentations, reports and drawings
- Develop a communications and marketing plan
- Seek all necessary regulatory and legal approvals
- Ensure all Intellectual Property is protected
- Provide all necessary materials to the manufacturer or developer for full production of the product, system or environment

