# STEM THINKING

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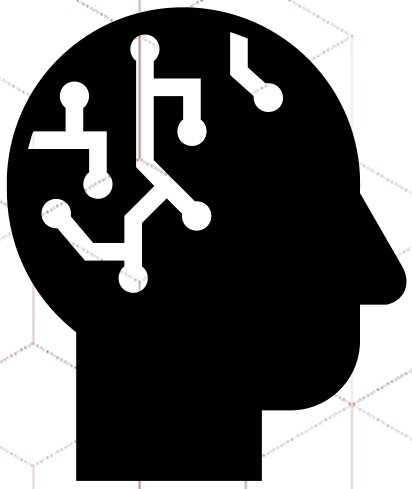
*Probably the most important skill that children learn is how to learn. …*
***Too often we give children answers to remember rather than problems to solve.***
*This is a mistake.*

*— Roger Lewin*

# Developing STEM thinking



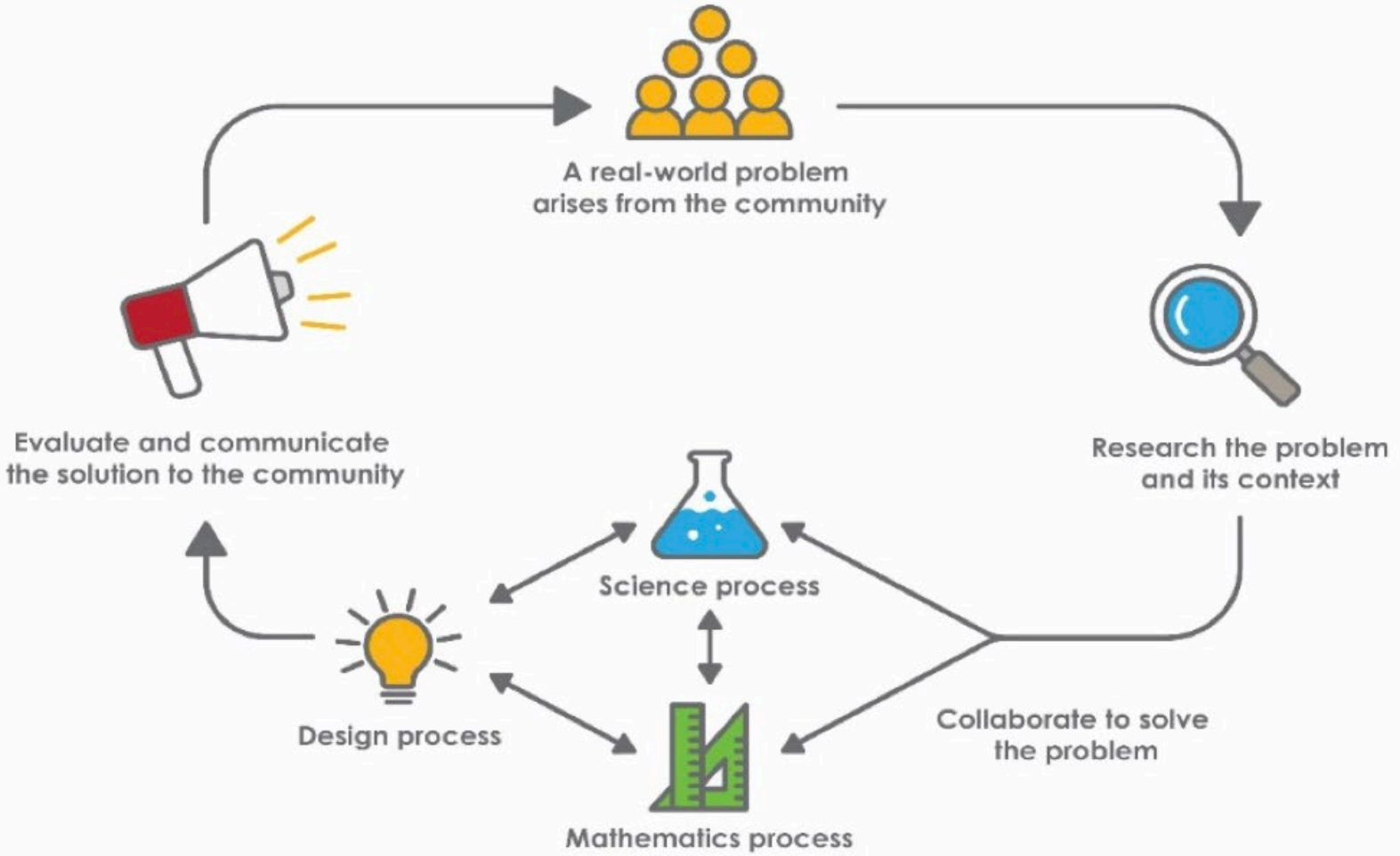
*involves **cultivating a mindset** that integrates the principles of **S**cience, **T**echnology, **E**ngineering, and **M**athematics **to solve real-world problems, understand complex systems, and innovate**.*

# Strategies to Foster STEM Thinking

- Interdisciplinary Learning
- Emphasis on Problem-Solving
- Developing High-Order Thinking
- Collaborative Learning
- Reflective Practice
- Integrating Technology
- Applying Real-world Connection

# Developing students' STEM capability

## Using problem-based learning pedagogy

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# STEM in Elementary Education

| Year | Title | Driving question |
|---|---|---|
| **Kindergarten** | Creepy crawly castle | How can we encourage minibeasts to visit and live at our school? |
| | I like quiet, I like noise | Where and when should we use loud voices or quiet voices in our school? |
| | Swooping birds | How can we protect ourselves from swooping birds? |
| **Pre-primary** | Animal rescue | How can we design and make a model of a structure that animals can use to cross a road safely? |
| | Chairs for bears | How can we make a chair that is comfortable, safe and the right size for our toy? |
| | Water flow | How can we effectively transport water from a source to where it is needed? |

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| Year | Title | Driving question |
|---|---|---|
| **Year 1** | Growing food | How can we optimise the growth of our plants? |
| | Our magnificent thing | What problem in your life could you solve by building something with reused materials? |
| | Rice baby | How can we make a device to keep our babies safe? |
| **Year 2** | Cryptic code | How can we make a bilingual sign? |
| | Every bird needs a home | How can we improve or create habitat at our school that will encourage local species of birds to visit, live and breed? |
| | Little Red Hen's robot friend | How can robots help us? |
| | Waste warriors | How can we reduce waste at our school? |

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| Year | Title | Driving question |
|---|---|---|
| **Year 3** | Cool lunch | How can we design a lunch container that will help protect food from being spoilt? |
| | Plastic pollution | What can we do to reduce the pollution caused by plastics? |
| | The long walk | How can you design shoes using recycled materials? |
| **Year 4** | Honey bees | How can we raise awareness about the importance and the plight of the honey bee? |
| | Mini robot garden | How can we use automation to sustain a garden? |
| | Our new playground | How can playground equipment be designed to be engaging and exciting? |

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| Year | Title | Driving question |
|---|---|---|
| **Year 5** | Biosecurity | How can we protect Australian food production? |
| | Evacuation robot | How can we design an evacuation route and program a robot to safely guide students from their classroom to a muster point in the event of an emergency? |
| **Year 6** | Bushfire risk warnings | How do you determine the risk of a bushfire occurring in order to issue an appropriate warning? |
| | Caring for country | How can we restore native vegetation disturbed by natural events or human activity? |
| | Living off-grid | How can we develop simple and sustainable living solutions? |
| | Travel choices | How can we engage the school community in making better travel choices? |

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# STEM is naturally unplugged

# How to teach Computational Thinking together with STEM Thinking?

# Three components of computational thinking

- **Algorithmic Thinking**
  - Abacus,
  - Logic Quantifiers
  - Steepest descent
- **Use, Selection, Adaptation and Building (USAB) Computational Models**
  - Chemotaxis
  - Forest Fire Propagation
  - Pandemia propagation
- **Machine Learning Thinking**
  - Decision Tree Induction,
  - Linear equations and Neural Networks

# Science

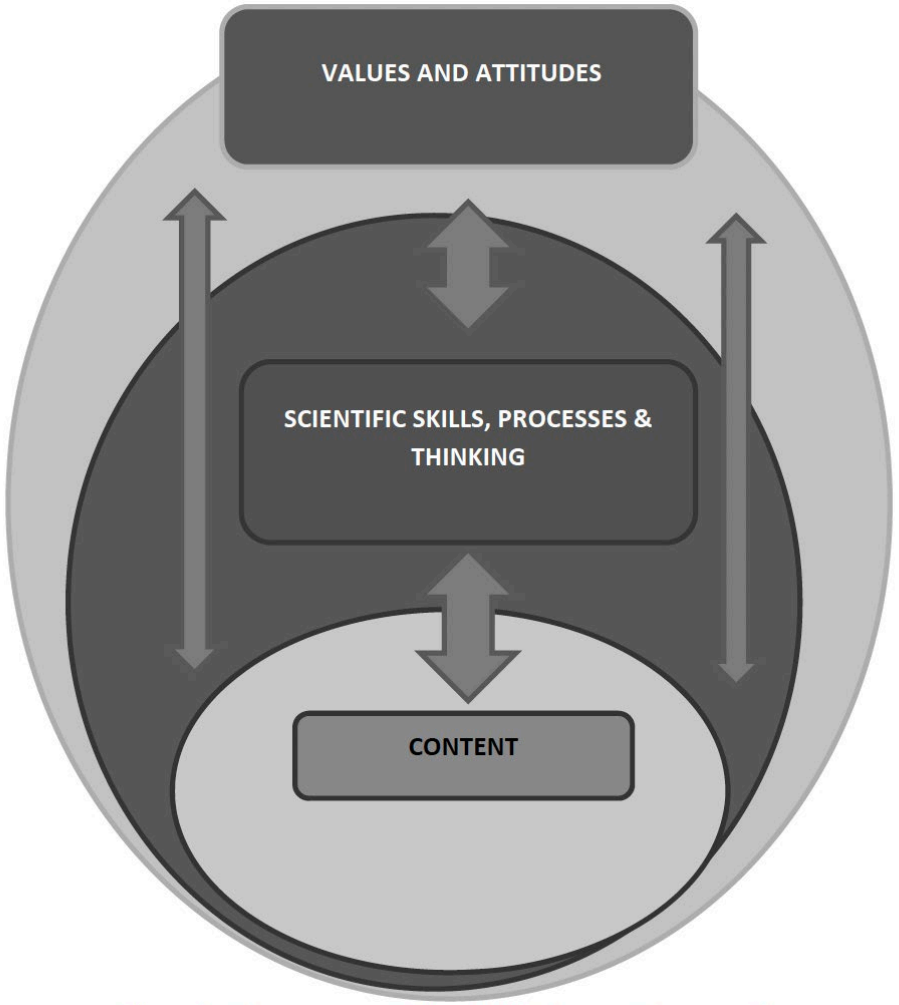
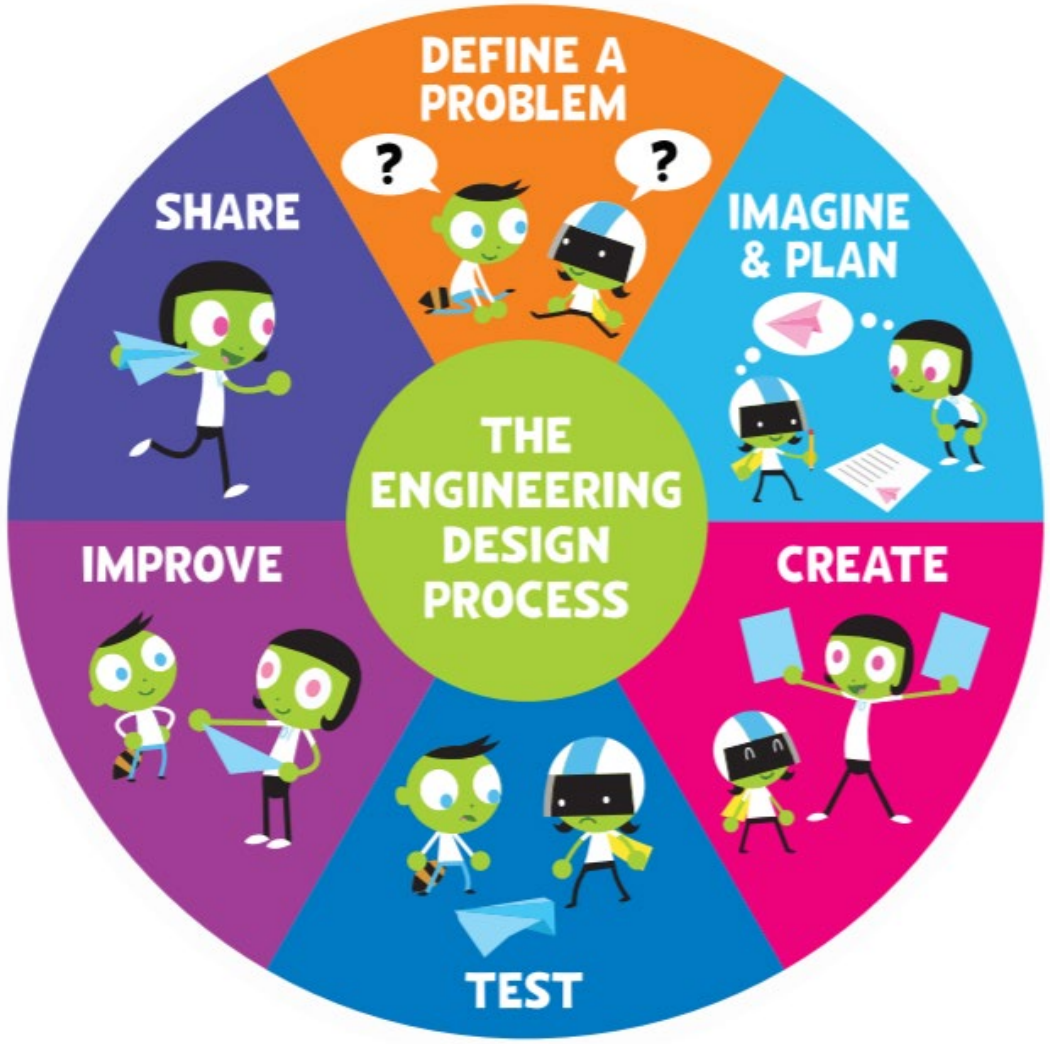



*Figure 3*. Components of the CCRLS Science framework.

Table 1
*Components of CCRLS Science Framework*

| Content | Scientific Skills, Processes and Thinking | Values and Attitudes |
|---|---|---|
| • Scientific Inquiry<br>• Life and the Living World<br>• Material World<br>• Energy and Change<br>• Earth and Space<br>• Science, Engineering, and Technology for Sustainable Society | **Science Skills and Process**<br>• Questioning<br>• Observing<br>• Classifying<br>• Measuring<br>• Hypothesizing<br>• Predicting<br>• Inferring<br>• Explaining<br>• Communicating<br>• Evaluating<br>• Identifying and controlling variables<br>• Formulating and testing hypothesis<br>• Defining operationally<br>• Interpreting data<br>• Planning and carrying investigations<br>**Thinking**<br>• critical and creative thinking<br>• reasoning<br>• problem solving<br>• decision making<br>• applying and creating<br>• generating solutions<br>• safe use of equipment<br>• ICT skills<br>• Collaboration skills | • Caring for the living and non-living environment<br>• Social awareness<br>• Sustainability<br>• Responsibility<br>• Truth<br>• Interdependence<br>• Integrity<br>• Perseverance<br>• Self-discipline<br>• Self-esteem<br>• Empathy<br>• Appreciation<br>• Trust<br>• Critical reflection<br>• Inventiveness<br>• Tolerance<br>• Uncertainty<br>• Belief and interest<br>• Curiosity<br>• Honesty<br>• Objectivity<br>• Open-mindedness<br>• Respect for evidence |

# Engineering




From: https://www.wxxi.org/highlights/engineering-stem-challenges/

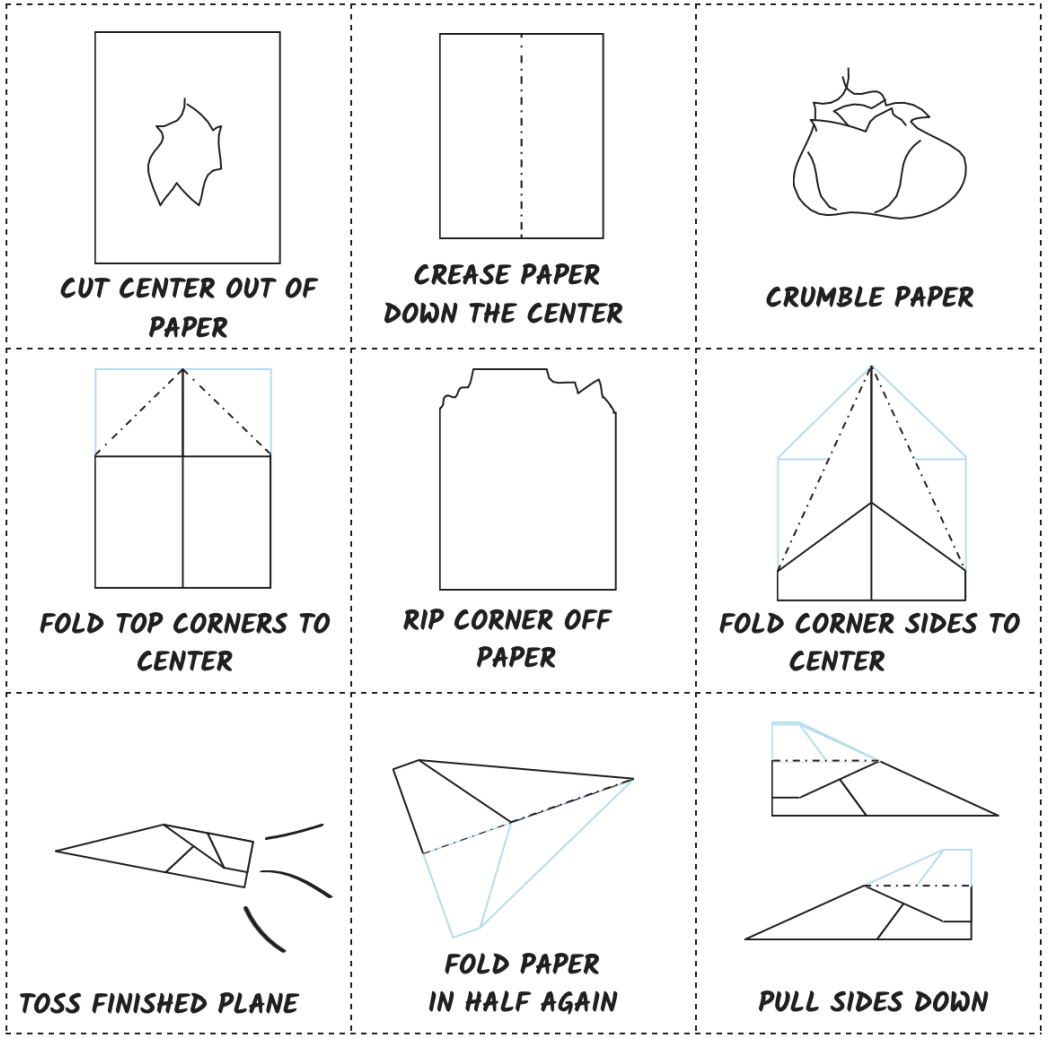
# CT with STEM Approach for Primary Education

- **Worksheet 3.1** – Colouring Activities + Experiments
- **Worksheet 3.2** – Colouring Activities + STE(A)M
- **Worksheet 3.3** – Decomposition
- **Worksheet 3.4** – Algorithmic Thinking
- **Worksheet 3.5** – Pattern Recognition
- **Worksheet 3.6** – Neural Networks

# Algorithmic Thinking

1.Make a copy of the worksheet above. Cut out the steps of making an airplane.
2.Glue the six correct steps, in order, onto a separate piece of paper.
3.Make an actual paper plane following these steps.

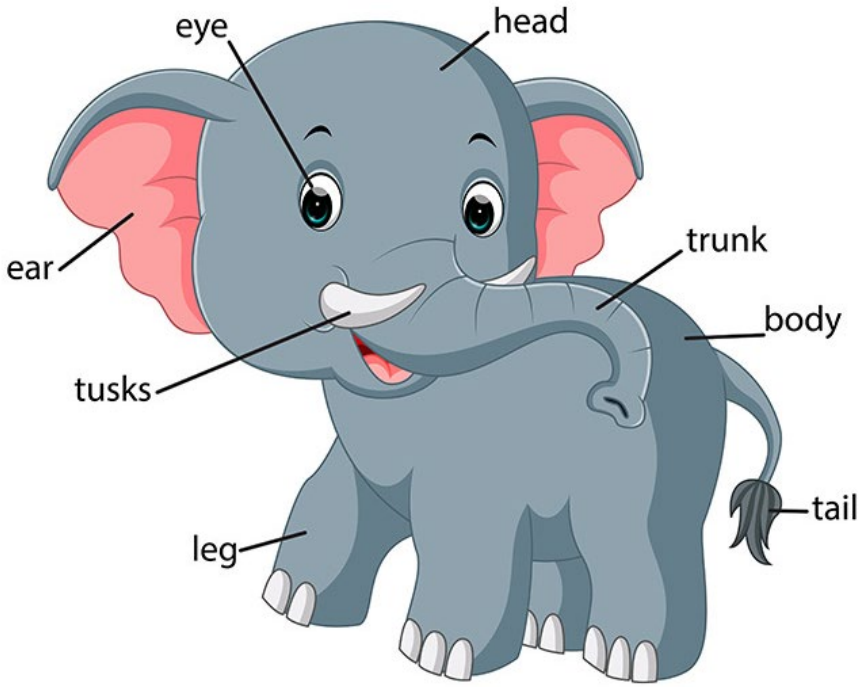
1.Have another student fold other types of airplanes, without other students seeing how the plane is folded.
2.Show the finished paper plane to other students.
3.Unfold the folded plane back into a single page
4.Let other students try to fold the paper to the airplane again by observing the folded line on the paper.
5.Let the student discuss how they think



# Pattern Recognition/Machine Learning



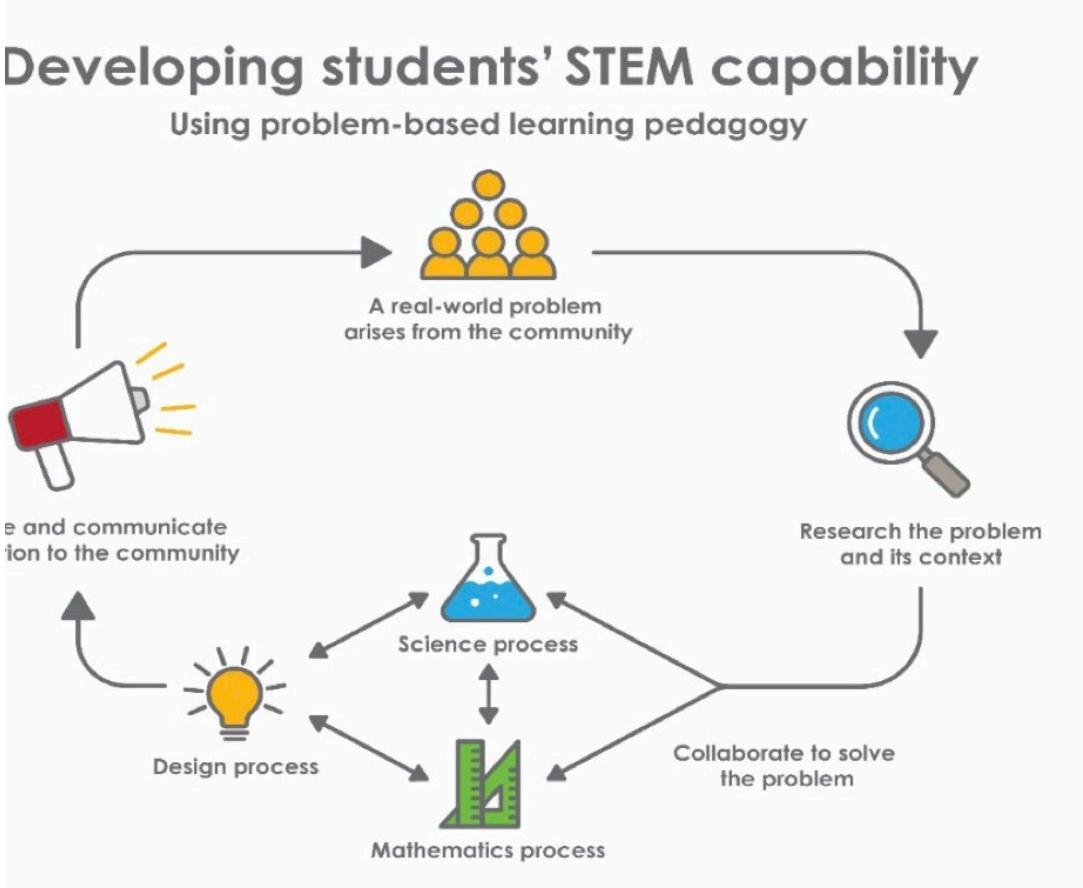

1.Identify elements that make you recognise the animal in these pictures as elephants. List down those elements.
2.Identify behaviour of the elephants, what do they usually do.




https://www.firstcry.com/intelli/articles/teach-your-kids-about-elephant-body-parts/

# Foster STEM & Computational Thinking?

- Interdisciplinary Learning
- Developing High-Order Thinking
- Collaborative Learning
- Reflective Practice
- Integrating Technology
- Applying Real-world Connection
- Emphasis on Problem-Solving



# Thank You