Nurturing students’ creativity and language skills by enriching the English language curriculum with STEM elements

Buddhist Wong Cheuk Um Primary School

• Ms Harriet Chow (English panel head)
• Mr Simon Chan (GS panel head, English teacher)
• Ms Rita Wong (Assistant English panel head)
Answer two questions by (1) Choosing an answer (2) typing

Enter the code: 57 52 38

Go to www.menti.com and use the code 57 52 38
Frequently Asked Questions:

1. Why should English teachers get involved in STEM education? What is the role of English teachers?

2. How to link the teaching of English language with STEM elements?

3. What are the difficulties of infusing STEM elements in the English subject?

4. How do different subjects work together?

5. How to assess the project?

6. What is the impact of the project?
Why infuse STEM education into the English Language curriculum?

Why should English teachers get involved in STEM? What is the role of English teachers?
To promote STEM education, English teachers can:

- Introduce English reading materials to guide students to discuss critically the issues related to mathematics, science and technology.
- Appreciate the contributions and achievements of famous and successful people in these areas to nurture an entrepreneurial spirit.

- Design tasks, activities, and projects to encourage students to work out innovative solutions to problems or create new ideas or things to enhance their creative capacity.

- Collaborate with other KLAs to enrich and connect experiences through RaC and life-wide learning activities.
The P5 English curriculum

Making things is fun!

Text type: • instructions (recipe, making art and crafts)
Vocabulary: • cooking     • arts and crafts
Language: • …use…to… • sequencing connectives

Be creative!

Text type: • magazine article (description, problem and solutions)
Vocabulary: • Materials (wood, cardboard, plastic, metal, glass)
Language: • …use for (gerund)…   • It is made of…
• Sequencing connectives

Fantastic People

Text type: • biography
Vocabulary: • jobs
Language: • past tense • present perfect tense

Initial rationale of infusing STEM elements in English subject:
Improving the design of the units

The learning targets were too easy
The learning targets were rather easy
Students were not interested in knowing about the famous people in the textbook
Promoting RaC in support of STEM education

Objectives:
• to equip students with reading to learn skills for science, mathematics and technology
• to help students make connections between the reading texts across various KLAs
• to strengthen their ability to integrate and apply knowledge and skills learned
• to broaden students’ knowledge base

Why should English teachers get involved in STEM? What is the role of English teachers?
Identifying related topics from GS and Maths subjects

**English subject**

- Famous people – Scientists (biography)
- Materials and making crafts (procedural texts)
- Electricity (from GS curriculum)
  - Electrical appliance
  - Conductors & Insulators
  - Procedural texts (closed circuit)
  - Factors affecting brightness of light bulb
- Inventions
  - 3D shapes (from Maths curriculum)
    - Faces/sides, edges and corners/vertices of different 3D shapes

**Project: Lamp production**

- Vocabulary • reading • writing • speaking • listening
**Stage 1 (2016/17): Start from English Language subject**

**Strategy: Infusing STEM elements into the English Language Curriculum**

### The STEM elements

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<thead>
<tr>
<th>S</th>
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<tbody>
<tr>
<td><strong>Electricity</strong></td>
<td><strong>Presentation tools</strong></td>
<td><strong>Construction</strong></td>
<td><strong>3D shapes</strong></td>
</tr>
</tbody>
</table>
| • Electrical appliances  
  • Conductors and insulators  
  • Closed circuit | • Reading about inventions  
  • Asking students to use e-tools (*e.g.* video, Videolicious and Story Creator) to present their products. | • Task: Building a product with the closed circuit and the 3D shapes | |
**Module: Inventions**

**Strategy:** Infusing STEM elements

**Unit 1: Fantastic people**

**The Inventors**

- **Language skill:** reading
- **Text type:** biography about scientists/inventors
- **Language:**
  - past tense
  - present perfect tense

**Unit 2: Making things is fun!**

**DIY lamp**

- **Language skills:** reading, writing & speaking
- **Text type:** procedural texts (how to form a closed circuit, how to make a lamp)
- **Language:**
  - ...use...to...;
  - ...use... for (gerund)...;
  - It is made of...;
  - sequencing connectives
- **Vocabulary:**
  - materials (insulators and conductors)
  - 2D shapes
  - 3D shapes
- **Task:** Making a lamp

**Unit 3: Inventions**

- **Language skills:** reading & listening
- **Text type:** magazine articles
- **Vocabulary:**
  - inventions
  - inventors
  - technology

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**Collaboration mode**

- Initiated by English Language subject
- English panel head introduced the project to GS and Mathematics teachers
- The module was delivered after the GS unit ‘Electricity’ and Mathematics unit ‘3D shapes’
Student work

- Students’ creativity, collaboration and problem solving skill nurtured
Student work
Students were more motivated in learning and using English.
How to improve the project

Stage 1 (2016/17): Start from English Language subject

Cross-curricular collaboration

Expertise of teachers of different subjects

Balanced coverage of knowledge & language skills

Time

Reflection

English

Project learning

GS

Mathematics

3 What are the difficulties of infusing STEM elements in the English subject?
Stage 1 (2016/17):
Start from English Language subject

Stage 2 (2017/18):
Inter-disciplinary collaboration
Stage 2 (2017/18): Inter-disciplinary collaboration

Cross-curricular Project Learning
Invention: Lamp/Safety box production (designing & presenting)

What are the difficulties of infusing STEM elements in the English subject?
The STEM elements

Science (G.S.)
Unit: Electricity
• Electrical appliances
• Conductors and insulators
• Closed circuit

Technology (Eng)
Presentation tools
• Reading about inventions
• Using e-tools (e.g. Seesaw) to facilitate interactions.
• Using e-tools (e.g. Seesaw, Adobe Spark Video, etc) to present the products.

Engineering (Eng)
Construction
Task
Applying the Engineering Design Process Model
Building a lamp/safety box with the closed circuit and the 3D shapes

Mathematics
Unit: 3D shapes

How do different subjects work together?

Stage 2 (2017/18): Inter-disciplinary collaboration
Cross-curricular Project Learning

Invention: Lamp/Safety box production (designing & presenting)

Input

Food

1. Electricity
   - Electrical appliances
   - Materials + Conductors and Insulators
   - Procedural texts (closed circuit)
   - Factors affecting brightness of light bulbs

2. Mathematics
   - 3D shapes
     • Faces/sides, edges and corners/vertices of different 3D shapes

3. English Language
   - Famous people – Scientists (biography)

4. IT
   - Apps application
     • Seesaw

5. Visual Arts
   • Materials
   • Craft
   • Skills

Stage 2 (2017/18): Inter-disciplinary collaboration

Product

Cross-curricular Project Learning

Invention: Lamp/Safety box production (designing & presenting)
Stage 2 (2017/18): Inter-disciplinary collaboration

Cross-curricular Project Learning
Invention: Lamp/Safety box production (designing & presenting)

The Engineering Design Process

- Define the problem
- Search for information
- Brainstorm possible solutions
- Make it
- Sketch
- Think
- Adjust the design
## Guiding questions of the Engineering Design Model (EDP)

<table>
<thead>
<tr>
<th>Ask</th>
<th>Imagine</th>
</tr>
</thead>
<tbody>
<tr>
<td>- What are the problems?</td>
<td>- Where do you look for the information required?</td>
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<tr>
<td>- What are the constraints?</td>
<td>- What have you read or viewed?</td>
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<td>- What have you learned?</td>
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<td>- What are the possible solutions?</td>
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<td>- Which solution will you adopt? Why?</td>
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<tbody>
<tr>
<td>- What is the design of your product (e.g. appearance, size, shape, use of materials)?</td>
<td>- What are the sequential steps of building your product?</td>
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<td>- How do you divide the jobs among the group members?</td>
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<td>- What difficulties have you encountered during the process?</td>
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<td>- How did you solve the problems you encountered?</td>
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<td>- Did all the proposed solutions work? Why/why not?</td>
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<td>- Can you suggest ways to modify the design of the product?</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Improve</th>
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<tbody>
<tr>
<td>- How is the modified design different from the previous design?</td>
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<tr>
<td>- What are the factors that lead to success?</td>
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<tr>
<td>- What are the factors that lead to failure?</td>
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</tbody>
</table>
How do different subjects work together?

**General Studies**
1. Conductors & insulators
2. Closed circuit

**Mathematics**
1. 3D shapes and models

**English Language**
1. Biography
2. Procedural text
3. Explore parallel and series circuit
4. Discuss the uses of different materials and reasons
5. Write procedural text, make presentation and comment

**Computer Studies**
1. Seesaw:
   - Video
   - Camera Roll
   - Take a photo
   - Add captions
   - Give comments
2. Adobe Spark Video

**Visual Arts**
1. Make the lamp/safety box with different materials based on the design plan
2. Solve problems
3. Test and improve
Timeline (from top to bottom)

(D) How different subjects collaborate

**English Language**
- **Project**
  - Introduce the objectives of the project
  - Discover and discuss problems at school
  - Introduce the Engineering Design Process
- **Module: Inventions**
  - **Unit 1: Fantastic People**
    - Teach non-fiction reading skills through reading biographies about inventors and scientists — sequence
    - Reflect on the characters of the inventors and scientists
- **Project**
  - Design the product
  - Plan the procedures to make the product
  - Unit 2: Making things is fun
  - Consolidate the learning of concepts and target vocabulary in GS lessons
  - Teach non-fiction reading skills through reading procedural texts about forming a closed circuit
  - Write procedural texts about forming a closed circuit (using time adverbs and imperatives)
  - Use comparatives and superlatives to talk about the observations and solutions of hands-on activities: Factors affecting the brightness of the light bulbs

**General Studies (GS)**
- **Module: Electricity**
  - Plan and organise the PS cross-curricular project about electricity
  - Introduce content subject knowledge
  - Hands-on activity: forming a closed circuit
  - Conductors and insulators
  - How electricity relate to daily lives
  - What to pay attention to when using electricity

**Mathematics**
- **Unit: 3D Shapes**
  - Introduce content subject knowledge
  - Number of faces/edges/corners of different 3D shapes
  - Relationships between the number of faces and edges
  - Introduce target vocabulary in English (e.g. cube, cylinders, pyramids, sphere, prism)
  - Conduct hands-on activity: making 3D shapes with clay and toothpicks (label the products in English)

**Computer Studies**
- **Project**
  - Teach the use of apps e.g. Seesaw

**Visual Arts**
- **Project**
  - Produce the product
  - Improve the product

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Case title: Nurturing students' creativity and language skills by enriching the English language curriculum with STEM elements
25 June 2018
To promote STEM education, English teachers can:

3.4.2 Collaboration with other KLAS

- design tasks, activities and projects to encourage students to work out innovative solutions to problems or create new ideas or things to enhance their creative capacity

- provide opportunities for applying language skills
### Timeline (from top to bottom)

#### (D) How different subjects collaborate

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#### Project

- Plan
- Create
- Improve
- Revise the plan and upload it to Seesaw

- **Unit 3:** Be creative!
- Teach non-fiction reading skills through reading articles about inventions
- Teach presentation skills
- Present products with Adobe Spark Video
- Share videos on Seesaw

- **Unit 4:** Be creative!
- Produce the product
- Improve the product
Designing tasks to encourage students to
• create new ideas or new things to enhance their creative capacity
• provide opportunities for applying knowledge and skills across disciplines

Incredible STEM Project

Group no. __________
Groupmates: __________

(A) Objective of our STEM project
• To read non-fiction texts to learn about scientists, inventors and their inventions and engineers.
• To use the knowledge we learnt from Computer Studies, Math and General Studies lessons into our final productions.
• To write procedural texts about the productions which we make during Visual Art lessons.
• To present our productions clearly in both written and spoken forms.
• To be innovative! To take risks! To solve problems! To be creative! Not to be afraid of challenges.

(B) Purpose of our STEM project
Choose one of the questions below for your project question.

- Design a safety box to keep students' phones during school hours. You put your phones in there when you arrive school. You can only take your phones back when you leave school. No one should open the safety box during the school hours. E.g. sound - once it is opened, lights on when the phone is not there.
- The corridor and the staircase at the back of the playground are often very dark. It is not easy to walk up or down. It is not beautiful to look at either. We can design some lamps to decorate the area. There must include two elements of the closed circle e.g. light + sound; light + vibration; light + movement such as the windmill complex - light and also the movement of the fan.

(C) As engineers, inventors or scientists, we must follow The Engineering Design Process:

- Ask
- Imagine
- Create
- Plan
- Improve

“I have not failed. I’ve just found 10,000 ways that won’t work.” – Thomas Edison
The Engineering Design Process

How do different subjects work together?

- Search for information
- Brainstorm possible solutions
- Choose a solution

English language skills:
- Vocabulary building
- Reading
- Listening
- Writing
- Speaking (Discussions & Presentations)
- Giving comments

Designing tasks to encourage students to
- create new ideas or new things to enhance their creative capacity
- provide opportunities for applying knowledge and skills across disciplines

Choose one of the questions below for your project question.

- Design a safety box to keep our mobile phones in the classrooms

- Design a lamp to lit up a dark corridor and the staircase

Ask
What are the problems?
- What are the constraints?

Imagine
Brainstorm possible solutions
- Choose a solution
## (D) How different subjects collaborate

### English Language

**Module: Inventions**
- **Unit 1: Fantastic People**
  - Teach non-fiction reading skills through reading biographies about inventors and scientists – sequence
  - Reflect on the characters of the inventors and scientists
  - Consolidate the learning of concepts and target vocabulary in GS lessons
  - Teach non-fiction reading skills through reading procedural texts about forming a closed circuit
  - Write procedural texts about forming a closed circuit (using time adverbs and imperatives)
  - Use comparatives and superlatives to talk about the observations and solutions of hands-on activities: Factors affecting the brightness of the light bulbs

**Unit 2: Making things is fun**
- Present the item to the class
- Revise the plan and upload it to Seesaw

### General Studies (GS)

**Module: Electricity**
- Plan and organise the P5 cross-curricular project about electricity
- Introduce content subject knowledge
  - Hands-on activity: forming a closed circuit
  - Conductors and insulators
  - How electricity relate to daily lives
  - What to pay attention to when using electricity
- Introduce target vocabulary in English (e.g. light bulb, batteries, electric wires, switch, closed circuit)

### Mathematics

**Unit: 3D Shapes**
- Introduce content subject knowledge
  - Number of faces/edges/corners of different 3D shapes
  - Relationships between the number of faces and edges
  - Introduce target vocabulary in English (e.g. cube, cylinders, pyramids, sphere, prism)
  - Conduct hands-on activity: making 3D shapes with clay and toothpicks (label the products in English)

### Computer Studies

- Teach the use of apps e.g. Seesaw

### Visual Arts

- Create the product
- Improve the product

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**Timeline (from top to bottom)**

**Case title:** Nurturing students’ creativity and language skills by enriching the English language curriculum with STEM elements

25 June 2018
How to implement (General Studies)

Vocabulary input

Knowledge building

Electrical appliances

Closed circuit

In a closed circuit, the path is complete, so the electricity can flow.

Materials

Conductor – Any material that allows electric current to pass through it
- copper
- aluminum
- steel
- any metal

Insulator – Any material that does not allow electric current to pass through it
- like the protective coating on wires
- plastic
- rubber
- glass
- cloth
- wood

Word cards

How do different subjects work together?

Imagine

- Search for information
- Brainstorm possible solutions
- Choose a solution

The Engineering Design Process
### Timeline (from top to bottom)

<table>
<thead>
<tr>
<th>Language Learning Support Section Annual Sharing 2018</th>
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<tbody>
<tr>
<td>&quot;Broadening students’ learning experiences through enhancing Values Education, Assessment Literacy and Reading across the Curriculum&quot;</td>
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#### (D) How different subjects collaborate

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</table>

#### Module: Inventions
- **Unit 1: Fantastic People**
  - **Teach non-fiction reading skills** through reading biographies about inventors and scientists – sequence
  - **Revisit the characters of the inventors and scientists**

#### Project
- **Introduce the objectives of the project**
- **Discover and discuss problems at school**
- **Introduce the Engineering Design Process**

#### Unit 2: Making things fun
- **Consolidate the learning of concepts and target vocabulary in GS lessons**
- **Teach non-fiction reading skills** through reading procedural texts about forming a closed circuit
- **Write procedural texts** about forming a closed circuit (using time adverbs and imperatives)
- **Use comparatives and superlatives** to talk about the observations and solutions of hands-on activities: *Factors affecting the brightness of the light bulbs*.

#### Project
- **Design the product**
- **Plan the procedures to make the product**

#### Unit 3: 3D Shapes
- **Introduce content about subject knowledge**
  - **Number of faces/edges/corners of different 3D shapes**
  - **Relationships between the number of faces and edges**
- **Introduce target vocabulary in English** (e.g. cube, cylinders, pyramids, sphere, prism)
- **Conduct hands-on activity: making 3D shapes with clay and toothpicks (label the products in English)**

#### Project
- **Produce the product**
- **Improve the product**

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**Case title:** Nurturing students’ creativity and language skills by enriching the English language curriculum with STEM elements  
**25 June 2018**
Math teachers show vocabulary in English while teaching 3D concepts.

The Engineering Design Process

Imagine

• Search for information
• Brainstorm possible solutions
• Choose a solution

Making 3D shape models with clay and toothpicks

Word cards

<table>
<thead>
<tr>
<th>3D shapes</th>
<th>Shapes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prism</td>
<td>triangle</td>
</tr>
<tr>
<td></td>
<td>circle</td>
</tr>
<tr>
<td></td>
<td>rectangle</td>
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<tr>
<td></td>
<td>heart</td>
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<td></td>
<td>square</td>
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<td></td>
<td>oval</td>
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<td></td>
<td>octagon</td>
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<tr>
<td></td>
<td>star</td>
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<td></td>
<td>diamond</td>
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</table>

Faces/sides, edges and corners/vertices of 3D shapes
### Timeline (from top to bottom)

#### English Language

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</tbody>
</table>

#### Project

- **Plan**
  - Teach non-fiction reading skills through reading biographies about inventors and scientists - sequence.
  - Reflect on the characters of the inventors and scientists.
- **Create**
  - Design the product.
  - Plan the procedures to make the product.
  - Plan: Making things is fun.
  - Consolidate the learning of concepts and target vocabulary in GS lessons.
  - Teach non-fiction reading skills through reading procedural texts about forming a closed circuit.
  - Write procedural texts about forming a closed circuit (using time, adverbs, and imperatives).
  - Use comparatives and superlatives to talk about the observations and solutions of hands-on activities: Factors affecting the brightness of the light bulbs.
- **Improve**
  - Consolidate the learning of concepts and target vocabulary learned in Math lessons.
  - Read a 3D shape poem and identify rhyming pairs.
  - Read a short description about a home electrical appliance.
  - Apply the target vocabulary to the mini-writing: Describe an item at home.
  - Present the item to the class.
- **Review**
  - Revise the plan and upload it to Seesaw.

#### Computer Studies

- Teach the use of apps e.g. Seesaw.

#### Visual Arts

- Create products and improve the product.
Unit 1: Fantastic People
To promote STEM education, English teachers can:

- **introduce English reading materials** to guide students to discuss critically the issues **related to mathematics, science and technology**, and appreciate the contributions and achievements of famous and successful people in these areas to nurture an **entrepreneurial spirit**

**Entrepreneurial spirit:**
- resilience
- innovativeness
- willingness to take calculated risks
- positive attitudes to cope with challenges and adversities
- always questions how things can be done better
• Identifying and introducing relevant reading materials in both print and non-print forms
• Helping students developing reading skills for understanding information texts:
  - Explicit teaching of text features and structures

### Biographies

1. Why do people write biographies?
   - To tell you about a famous person
2. What do the authors want to tell you?
   - The life of the famous people: achievements, characters, information about their family, their education, their work
3. What can you learn from the famous people?
   - Their characters, problems they had, how they solved the problems, what made them successful/famous

This is a pair of eye glasses.

This is used for looking at things clearly when you have short sights.

He is Benjamin Franklin. He invented eye glasses.

### Teaching of reading skills (information texts)

**Text structure: Sequence**

<table>
<thead>
<tr>
<th>Signal words</th>
<th>Graphic organisers</th>
</tr>
</thead>
<tbody>
<tr>
<td>soon</td>
<td>Timeline</td>
</tr>
<tr>
<td>not long after</td>
<td></td>
</tr>
<tr>
<td>when</td>
<td></td>
</tr>
<tr>
<td>while</td>
<td></td>
</tr>
<tr>
<td>on (date)</td>
<td></td>
</tr>
<tr>
<td>at (time)</td>
<td></td>
</tr>
<tr>
<td>in (year)</td>
<td></td>
</tr>
</tbody>
</table>

Name of the invention

Orville Redenboker

Timeline

- 1877
- 1878
- 1891

He married Mary

He invented the

and started the
• Developing reading skills for information texts: Identifying main ideas

**Biographies**

Learning about important attitudes that inventors possessed

---

**Don’t give up!**

• Inventors need to plan for a long time and have to try many times before they can get their invention to work the right way.

**No copy cats!**

• Once an invention works, inventors will need to get a patent.
• A patent makes sure that no one can copy their idea.
• Having a patent, the inventor can sell his/her invention to make money!

**Improvements!**

• Inventions can be modified to become better (e.g. improvement in functions and appearance)
• Improving the design or plan of an invention can benefit the users.

---

**Developing students’ entrepreneurial spirit**
Writing **reflections** after reading the biography of Thomas Edison

Thomas Edison was a famous inventor in history. He invented many useful items including the practical light bulb and phonograph. What have we learnt from Thomas Edison? Write two ideas with elaboration.

Thomas Edison never gives up no matter what he is facing. **We should learn from his attitude when we face challenges.** Thomas Edison didn’t stop inventing while enjoying his successes. We should also follow his attitudes on learning and keep enhancing our knowledge at anytime.

1. **Be curious – Read more and think more** like Edison spent most of his time and pocket money on different scientific experiments. Finally he invented a phonograph.

2. Never give up. Like Edison, even he failed hundreds of times, **he never gave up**. So finally he succeeded.
Writing **reflections** after reading about the life of Thomas Edison

Student’s work:
1. He insisted on his dreams to benefit the world.
2. Even if his body is flawed, he does not give up.

Teacher’s comment:
Inventors can be anyone that can help the world!

Student’s work:
I think Thomas Edison is full of determination and smart because he never gives up and he makes many inventions.

Teacher’s comment:
There may be tough times but the difficulties which you face will make you more determined to achieve your goals.

Teachers giving **feedback** to students to nurture their entrepreneurial spirit.
Unit 2: Making things is fun
Provide opportunities for students to use the vocabulary learned in the Math lesson and apply the sentence patterns learned in the English lessons.

(D) Look around you at home. Find an object at home that represents a shape, or shapes.

This is a fridge. It is a **rectangular prism**.

In the fridge, there are two cartons of juice. They are also **rectangular prisms in shape**.

There are two bottles of jam. They are the **shape of cylinders**.

This is a box. It is a **cube**.

In the box, there are ten chocolates. They are the shape of spheres. There are also two chocolates. They are the shape of **triangular prisms**. There are three ice-cream cones. They are the **shape of cones**.

This is a toy box. It is a **rectangular prism**.

In the toy box, there is a Rubik’s cube. It is cube in shape. There is a basketball. It is the **shape of sphere**.

This is a rubbish bin. It is a **rectangular prism**.

In the rubbish bin, there are two boxes. They are also **rectangular prisms in shape**. There are two bottles of water. They are the **shape of cylinders**.

Details are given! Very good!
Developing reading skills for information texts: Explicit teaching of text features and structures

Providing opportunities for applying language skills

**Instructions**

**How to form a closed circuit**

- Learning text features and text structures of procedural texts
- Writing the procedures
- Presenting the procedures
- Reading the procedural text “How to form a closed circuit”

**Text structure: Sequence**

- Signal words: first, second, third, next, then, after that, to begin/start with, finally
- Graphic organisers

**English language skills:**
- Vocabulary building
- Reading
- Writing
- Speaking (Presentations)
### Major text structures

<table>
<thead>
<tr>
<th>Text structure</th>
<th>Function</th>
<th>Signal words</th>
<th>Sample graphic organizer</th>
<th>Summary Questions</th>
</tr>
</thead>
</table>
| Description    | Explains something (e.g., topics, ideas, people, places and things) by listing characteristics, features and examples | • for example  
• such as  
• for instance  
• include  
• (no.) types of  
• (no.) kinds of  
• looks like  
• characteristics  
• most important  
• also  
• another  
• in addition | Concept map | • What specific person, place, thing, event, or concept is being described?  
• What does it look (or sound, feel, taste) like?  
• How does it work?  
• What does it do? |
| Sequence       | Describes how to make or do something | • first, second, third  
• then  
• after that  
• to begin/ start with  
• finally  
• in the beginning  
• at the end  
• before  
• at the same time  
• following  
• later  
• soon  
• not long after  
• when  
• while  
• on (date)  
• all (time) | Steps / Procedures | • What are the steps or procedures?  
• What is the sequence of events? |

**Examples**

**Description**

A topic, idea, person, place, or thing is described by listing its features, characteristics, or examples.

**Sequence**

Describes how to make or do something.

Steps/Procedures:
1. First, put a battery into the case.
2. Next, connect the bulb to the positive pole of the battery by a wire.
3. Then, connect the bulb to the negative pole of the battery by another wire.
4. Finally, a close circuit is formed.
Cause and Effect
Explain why or how something happened
- reasons why / reasons for
  - for this reason
  - if... then
  - as a result of
  - because
  - because of
  - caused by
  - since
  - so
  - lead(s) / led to
  - effect
  - effects of
  - result
  - outcome
  - impact
  - influenced by
  - consequently
  - therefore

Problem and Solution
States a problem / some problems and lists some possible solutions to the problem(s)
- problem is / problems are
  - challenge
  - because
  - since
  - question
  - answer
  - solved
  - to solve this problem
  - solution
  - one possible solution is
  - therefore
  - thus
  - so that

Text Structure
- What happened?
- Why did it happen?
- What caused it?
- What are/were the reasons for...?
- What are/were the effects of the event?
- What are/ were the results or outcomes?

Text Structure
- What is/ are the problem(s)?
- Who has / has had the problem?
- Why is this a problem?
- What is wrong?
- What can be done to solve the problem?
- What can be improved or changed?
- What are the pros and cons of the solutions?
In 17/18 “STEAM” project, we have used:

**Sequence** - Timeline of Thomas Edison and the making of closed circuit

**Description** - Describe an electrical appliance at home using words learnt from Math lesson (e.g. 3D shapes) and describe the inventions (e.g. size, colour, uses, etc)

**Problem-solving** – Analyzing the uses and reasons inventions are invented during the reading of “Children can be inventors too!”
Designing challenging activities:
Discover problems and innovative solutions to the problems

Form a closed circuit with two light bulbs and a switch (with a partner)

What have you discovered? (Hint: What happened to the light bulb?)

Form a closed circuit with three or more light bulbs and a switch (in groups)

Is water a conductor?

Answer:
Pure water is an insulator.
However, impurities in the water make it a conductor.
Therefore, tap water is a conductor.

How do different subjects work together?

Language input:
- **Comparatives** (e.g. dimmer, brighter)
- **Superlatives** (e.g. e.g. dimmest, brightest)
- **Imperatives**
Unit 3: Be Creative!
• Identifying and introducing relevant reading materials in both print and non-print forms
• Helping students developing reading skills for understanding information texts:
  - Extensive reading
  - Explicit teaching of text features and structures

Reading materials about inventions

Listening task sheet (fill in the blanks)

English language skills:
• Vocabulary building
• Reading
• Listening (Multimodal texts)

Listening task sheet 2
Ss evaluation of each invention presented
Teaching of reading skills (information texts)

Reading about inventions

Text structures:
• Description
• Problem & solution
• Sequence

Signal words

<table>
<thead>
<tr>
<th>Problems and solutions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why the inventions were created</td>
</tr>
<tr>
<td>How the inventions solve the problems</td>
</tr>
</tbody>
</table>

| Description of the inventions:                  |
| what the invention is                           |
| problem(s) to solve                             |
| the functions of the invention                  |
| the features of the invention                   |
| the materials used to make the product          |
| how to use the product                          |

<table>
<thead>
<tr>
<th>Signal words</th>
</tr>
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<tbody>
<tr>
<td>for example</td>
</tr>
<tr>
<td>such as</td>
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<tr>
<td>for instance</td>
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<tr>
<td>include</td>
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<tr>
<td>(no.) types of</td>
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<tr>
<td>(no.) kinds of</td>
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<tr>
<td>looks like</td>
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<tr>
<td>characteristics are</td>
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<tr>
<td>characteristics of</td>
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<tr>
<td>most important</td>
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<tr>
<td>also</td>
</tr>
<tr>
<td>another</td>
</tr>
<tr>
<td>in addition</td>
</tr>
</tbody>
</table>

| Graphic organisers                              |

<table>
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<tr>
<td>next</td>
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<td>then</td>
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<td>after that</td>
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<td>to begin/ start with</td>
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<td>finally</td>
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</table>
Children can be Inventors too!

By William Evans

Inventors are adult scientists who work in laboratories, right? Wrong! Children can be inventors too.

Thirteen-year-old Chester loved ice-skating, but he hated having cold ears. His solution – earmuffs! They were made of metal wire and animal fur. At first Chester’s friends laughed at him. Then they saw that Chester could keep warm while they went home with cold ears. Everybody wanted earmuffs then!

Fourteen-year-old Becky’s invention helps doctors all over the world – and astronauts all over space! Becky put special paint under her writing paper because she wanted to write in the dark. Now her invention, Glo-Sheet, is used for reading patients’ information in hospitals at night. It is also used in spaceships when the lights are turned off to save energy. Amazing!

Some schools encourage their students to be inventors. Recently, children at a local school showed their inventions. A Primary 5 student, David, invented a ‘cool cap’. It has pockets for ice. David said, ‘I get hot running around. My cap is used for staying cool on hot days.’

Another student, Lucy, was worried that her fish were bored. Her invention is made of brightly-coloured plastic tubes. Lucy’s fish love swimming through them.

If you have an idea, don’t be afraid to try it out. Use things that you can find at home. The first television was made of cardboard, wood, string and metal needles. It was very different from today’s televisions, but it was a start. Remember, a journey of a thousand miles starts with a single step. Take that step today!
Read P.10-11 of Book 5B. Write down the information about the kids’ inventions.

<table>
<thead>
<tr>
<th>Invention</th>
<th>Name of Inventor</th>
<th>Age</th>
<th>Invention</th>
<th>Materials</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Chester</td>
<td>13</td>
<td></td>
<td>metal wire and</td>
<td>To keep the ears</td>
</tr>
<tr>
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<td>To help people</td>
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<td>3.</td>
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<td>and a</td>
<td>To help people</td>
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<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>For to through</td>
</tr>
</tbody>
</table>

- **High order thinking skills:**
  - How did Chester make it?
  - Can you tell the steps?

**Teachers make the final remarks of using the message of the text:**

* A journey of a thousand miles starts with a single step. That step today.
The Engineering Design Process

How do different subjects work together?

- Search for information
- Brainstorm possible solutions
- Choose a solution

Designing tasks to encourage students to
- create new ideas or new things to enhance their creative capacity
- provide opportunities for applying knowledge and skills across disciplines

English language skills:
- Vocabulary building
- Reading
- Listening
- Writing
- Speaking (Discussions & Presentations)
- Giving comments

Ask
What are the problems?
- What are the constraints?

Imagine
Brainstorm possible solutions
- Choose a solution

Choose one of the questions below for your project question.

- Design a safety box to keep our mobile phones in the classrooms
- Design a lamp to lit up a dark corridor and the staircase
Making lamps/safety boxes

How to form a close circuit?

• First put a battery into the case.
• Next connect the bulb to the positive pole of the battery by a wire.
• Then connect the bulb to the negative pole of the battery by another wire.
• Finally a close circuit is formed.
Plan your design. Draw and label the materials you need for your lamp.

- What is the design of your product (use of materials, size, shape)?
- How do you divide the jobs among the group members?

First use glue to stick the lolly sticks together.

Next tie a string to the lolly sticks.

Then stick the papers to the lolly sticks and put a closed circuit and light bulb into the "unfinished lamp".

Finally, switch it on.
The Engineering Design Process

Steps:
1. First connect the light bulb electric wires, batteries, and the condy such together to make a closed circuit.
2. Then blow the balloon.
3. Next wind the ball with the wet glue-covered string.
4. After that, I leave the balloon to dry.
5. Then remove the balloon carefully.
6. Finally put the closed circuit inside the lamp.

What is the design of your product (use of materials, size, shape)?

How do you divide the jobs among the group members?

What were the sequential steps you took to build your tool?

What difficulties did you encounter during the process?

How did you solve the problems you encountered?

Did it work? Why/Why not?

Can you suggest ways to modify the design?
Based on the plan, created the final product
After discussion, some students found that the planned design was too difficult to make.

Make compromises to improve the design

Improve the plan with the help of VA teachers
When encountering difficulties, students faced them and found solutions. In this group, they improved their products with different materials.
Nurturing students’ creativity, collaboration, problem solving skills, and foster their innovation.

Students were encouraged to **improve** the final products even if it deviated from the planned design to make them look better and brighter.
Making a safety box
Formative assessment (informs learning and teaching)

Summative assessment (measures attainment)

Learning and Teaching Process
- Sharing learning objectives with students
- Effective questioning
- Observation
  - Generic skills: Creativity, Problem solving, Collaboration, Communication
- Peer learning (e.g. collaborative learning)
- Effective feedback (e.g. clear advice for improvement)
- Active involvement of students in their own learning

Internal assessment
- Diversity
  - Different modes of assessment to match learning objectives and processes (e.g. reading, writing, presentation, Adobe Spark Video, the lamp/safety box)
  - Different parties (e.g. self/peer/teachers evaluation)
- Opportunities for students to learn and correct rather than compare marks with others
  - Construct 3D-shape models
  - Create the product:
    - Can the lights be lit up?
    - Can the product stand?
    - Is the product beautiful or artistic?
- Tests/examinations

Feedback loop
Using e-tools to facilitate formative assessment

1. Students uploaded their work on Seesaw and verbally present them.

2. Students gave peer feedback.
Using e-tools to facilitate formative assessment

1. Students gave “likes” to each other’s work and comments
2. Teacher gave feedback to students
3. Students viewed all comments
4. Teacher gave feedback to students
5. Students provided feedback to each other
6. Students used e-tools to facilitate formative assessment
Using e-tools to facilitate formative assessment

- Title of the design
- Introducing the features of the lamp/safety box (materials, 3D shape)
- How to make the lamp/safety box
- 1 difficulty they faced during the process – any solutions?
- Ending – What have we learned?
**Impact of STEAM**

<table>
<thead>
<tr>
<th>Curriculum</th>
<th>Teachers</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The English curriculum became invigorated by STEM-related elements</strong> (3D shapes, electrical appliances, closed circuits, materials and conductors and insulators)</td>
<td>English teachers • gained a better understanding of the curriculum of other KLAs and the link between different subjects • improved knowledge and skills in infusing STEM education into the English curriculum to help students learn English • became more competent in teaching reading skills for information texts</td>
<td>Students’ • language skills developed through performing the authentic tasks • learning to learn skills developed</td>
</tr>
<tr>
<td>• more challenging • more engaging • more motivating • more autonomous</td>
<td><strong>Learning context</strong> Cross-disciplinary collaboration: holistic planning of the school curriculum</td>
<td>searching, identifying and making effective use of the information collected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Entrepreneurial spirit developed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
|  |  | **Impact of the project?**
|  |  | • perseverance • creativity • collaborative • problem solving • taking calculated risks |
Tips for implementing STEAM projects

How to get other subjects involved

• Showing other content subject panel heads and teachers how the concepts and text types are connected
• Sharing with other content subject teachers about the design, the implementation and student work of the English project (Making a lamp) through formal and informal occasions

Informal chat

e-Platform
(e.g. WhatsApp, Google Classroom)

Sharing sessions (school-based PD)

Professional exchange
asking advice on how to teach the circuits, 3D shapes, make crafts

Lesson observation
Tips for implementing STEAM projects

How to create time for the project

- **Adopt STEM-related teaching materials** (e.g. the biography of Thomas Edison, the procedural text ‘How to form a closed circuit’)
- **Cross-curricular collaboration** (GS, Mathematics, Visual art, Computer studies)
- **Combining related components** (e.g. tasks, projects)
Weakness of the STEAM project:
(1) “Problems” are not discovered by students
(2) The element of reading can be strengthened. Get to know more about the strategies of Reading Across Curriculum (RaC)?
from...

Stage 1 (2016/17): Start from English Language subject

Stage 2 (2017/18): Inter-disciplinary collaboration

Stage 3 (2018/19): Focus on Reading and Design Thinking

What are the difficulties of infusing STEM elements in the English subject?
What are the difficulties of infusing STEM elements in the English subject?
Stage 3 (2018/19): Focus on Reading and Design thinking

**Targets**
1. Students define a problem from their everyday lives
2. Students think of solutions and making possible plans
3. Students can read extensively and strategically

**Strategies**
- Linking tasks to real-life situations
- High order thinking questions
- Reading strategies specifically for non-fiction text
- e-Learning

**Expected Outcomes**
- Students can define a problem
- Students can think of multiple solutions and choose the most possible one through calculating risks
- Students are equipped with specific reading strategies
Strength the teaching of reading
Bridging the story of Thomas Edison to the nowaday gadget: iPhone

What can we do with our phones nowadays?

- take photos
- listen to music
- watch videos
- surf the Net

message
call
lighting
record voice

150 years ago… (~Year 1868)
How did people send messages to each other?
How did people watch video and listen to music?
How did people see in the dark? Could people record their voice?

150 years ago, we…

- Telegraph
- Phonograph
- Light bulb
- Motion camera
Stage 3 (2018/19): Focus on Reading and Design thinking

150 years ago, we...

- Telegraph
- Phonograph
- Light bulb
- Motion camera

- message
- call
- listen to music
- record voice
- lighting

What is the problem?

How to solve it?

What is it?

What is it made of?

What is it used for?

What does it look like?

Who invents it?

Begin to cultivate students with the Engineering Design Process Model (EDP) to lay down some ground work for the later innovative task.

Reading strategies specifically for non-fiction text

Thomas Edison (1847-1931)

Beginning in 1847, he never gave up. In December 1877, he invented the phonograph which could record people’s sounds. People were so excited. Edison quickly applied for the patent. At the same time, he thought of making another invention. In those days, there were electric light bulbs but they went off very quickly. Edison looked for many ways to make the electric light bulb last for longer time. He worked very hard. He had not slept for many nights and finally he found the right material to make the first long-lasting light bulb.

On New Year’s Eve 1879, Edison showed his light bulbs to the world at Menlo Park. Everyone was amazed at his invention. Even after his successes, Edison did not stop inventing. He made many useful products for the world until he died in 1931. In his life, he had applied for 1093 patents and inspired many people until this day.

Do you have a hero in mind like Thomas Edison? What can we learn from him?
Explore strategies to help students read across the curriculum

**Pre-reading strategies**
- KWL
- THIEVES
- Book cover

**While-reading strategies**
- Facts and Opinions
- Guessing word meaning

**Post-reading strategies**
- KWL
- Values

**Reading strategies**

**Non-fictions**

**Text structures**
- Compare and contrast
- Description
- Sequence
- Cause and effect
- Problem and solution

**Text features**
- Signal words

**Text types**

**Reading strategies specifically for non-fiction text**
Stage 3 (2018/19): Focus on Reading and Design thinking

Crazy Kids’ Inventions Turned Into Real Products (16 Pics)
Stage 3 (2018/19): Focus on Reading and Design thinking

#2 Tooth-O-Matic

An invention by: Harry Hughes
Age: 12 Date: 11/11/18
The name of my invention is: Tooth-O-Matic

You put your toothpaste inside the brush and when you push the button it releases the tooth paste up the tube and out onto the brush. I think people who are in a rush might use it.

#4 Pringles Hook

An invention by: Giorgia Bisnay
Age: 11 Date: 4/11/15
The name of my invention is: Pringle Hook

You pull the hook to get more pringles out. It is used to use pringles as a meal.

#5 Food Cooler

An invention by: demolition zeller
Age: 6 Date: 25/11/15
The name of my invention is: Food cooler

Food cooler is a Sun and a Sun Ray it is called Sun Ray.
Students read a lot of texts from the websites. Using the EDP model, students started from **defining a problem** to **planning a solution**.

The crazy inventions you’ve read are made by children from around the world! Although you are children, you can be inventors too! Think of a problem in your life. Can you define a problem? **Can you think of ONE thing in your life that you can make something to improve?** You may gain Bonus marks by using “...made of...” and “...used for...” correctly.

The result was…
Research on how to “define a problem”
Strategies to define problems

How does an engineer define a problem?

An engineer asks a lot of questions to define a problem as specifically as they can and most importantly, as something that can be solved.

Ask questions

Investigate

define a potentially solvable problem
## Tips for implementing STEM projects

### Develop the project in a manageable scale

<table>
<thead>
<tr>
<th>Subjects</th>
<th>2016/17</th>
<th>2017/18</th>
<th>2018/19</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Language</td>
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</tr>
<tr>
<td>GS</td>
<td>GS (Recall)</td>
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<td>Mathematics</td>
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<tr>
<td>Visual Art</td>
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<td>Visual Art</td>
</tr>
<tr>
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<th>2017/18</th>
<th>2018/19</th>
</tr>
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<tbody>
<tr>
<td>Science</td>
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<table>
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<tr>
<th>Models</th>
<th>2016/17</th>
<th>2017/18</th>
<th>2018/19</th>
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<tr>
<td>--</td>
<td>Engineering Design Process (EDP)</td>
<td>Defining a problem Imagining situations Planning a solution Creating a prototype</td>
<td></td>
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</table>

- From ONE subject to involving other subjects
- From some elements of STEM to all elements of STEM
- From all elements of STEM to focusing on RaC and EPD
Way forward: Creating the prototypes

The Engineering Design Process

- Define the problem
- Search for information

- Adjust the design
- Brainstorm possible solutions

- Make it
- Think

- Improve
- Sketch
## Enriching the English language curriculum with STEM elements

<table>
<thead>
<tr>
<th>Level</th>
<th>Theme(s) for tailor-making Language skills</th>
<th>Creativity</th>
<th>STEM elements</th>
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<tbody>
<tr>
<td>2</td>
<td>Caring for others: Protect the egg campaign</td>
<td>Build an egg protector</td>
<td>S T E</td>
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<tr>
<td>4</td>
<td>A balance diet</td>
<td>Plan a healthy meal</td>
<td>S T M</td>
</tr>
<tr>
<td>5</td>
<td>Travelling Around Hong Kong</td>
<td>Plan an itinerary that is feasible</td>
<td>T M</td>
</tr>
<tr>
<td>6</td>
<td>Endangered animals</td>
<td>Design a carriage to help save the animals</td>
<td>S T E M</td>
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</tbody>
</table>
Nurturing students’ creativity and language skills by enriching the English language curriculum with STEM elements

A journey of a thousand miles starts with a single step. Take that step today.
Thank you