# SEAMEO RECSAM SEA-BES Phase 2(b)

# *Teaching to Transform: 21st Century Skills and Design Thinking in STEM Contexts*

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## Acknowledgements

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# Preface

SEAMEO RECSAM has long recognised and taken cognizance of the impact of STEM in the educational systems of the SEAMEO Member Countries. The 10th *Five-Year Development Plan FY 2015/2016-FY 2019-2020* provides evidence of the variety of projects that are implemented by the Centre: for example, training programmes, workshops, conferences and publications. One such recent 2017 publication is the *SEAMEO Basic Education Standards (SEA-BES) Common Core Regional Learning Standards in Science and Mathematics* (CCRLSSM, 2017) which included STEM in its goals and objectives. This book clearly outlines the learning standards and indicators designed to promote and enhance STEM in SEAMEO Member Countries.

The *CCRLS in Science and Mathematics* was used as a reference point in the selection of topics and standards when developing the STEM activities and workshop materials for the 2018 *Teaching to Transform: 21$^{st}$ Century Skills and Design Thinking in STEM Contexts* week-long Workshop. This SEA-BES project aligned with the SEAMEO Agenda Priority #7 "***Adopting a 21st Century Curriculum***" which prescribes the following:

> To pursue a radical reform through systematic analysis of knowledge, skills, and values needed to effectively respond to changing global contexts, particularly to the ever-increasing complexity of the Southeast Asian economic, sociocultural and political environment, developing teacher imbued with ideals in building ASEAN Community

The systematic analysis of knowledge, skills, and values occurred during the *Teaching to Transform* Workshop with the aim to develop a *STEM Planning and Design Learning (PaDL) Framework* and 10 associated learning sequences. The PaDL Framework was developed from the analysis of 14 commonly used Western planning models, and the experiences, knowledge, skills and values of the 85 expert ASEAN educators who attended the Workshop. In the development of the PaDL Framework, a number of principles guided the construction: to focus on the students, not the curriculum; to consider your vision, focus, objectives, and student needs; to consider the resources your Country has available; and finally to consider the tasks you have confidence in developing.

The final outcome of the *Teaching to Transform* Workshop is a book publication (currently at the editing stage) which features the PaDL Framework and the 10 learning sequences that were designed from and utilise the PaDL Framework. This current booklet presents Chapters 1 and 2 of this book publication. In Chapter 1, the two model components of the PaDL Framework are presented: one directed at the teacher, the other at the student. Chapter 2 provides an example of a learning sequence. This example presents the common layout used in each of the learning sequences.

**A/Prof. Gillian Kidman**

## The Collaboration Team

**Mr. Dominador Mangao** is a Science Specialist and is Acting Deputy Director for R & D Division, SEAMEO RECSAM. He is the project coordinator of the SEAMEO Basic Education Standards (SEA-BES) which published the "*Common Core Regional Learning Standards in Science and Mathematics*".

**A/Prof. Gillian Kidman, Dr. Hazel Tan and Mr. Roland Gesthuizen** are a STEM Education Research team from Monash University, Australia. Together they are working on the transdisciplinary nature of STEM teaching and STEM pedagogies. Gillian's Science based research, teaching and curriculum design is award winning at both the State and National levels in Australia. Hazel, originally from Singapore MOE, has research and teaching interests in secondary mathematics education, educational technology, and international comparative studies. Roland is a STEM Method Lecturer. His current PhD study concerns the how we teach to inform, and teach to transform in the STEM disciplines.

**Ms. Simone Macdonald** is an Australian teacher. She studied her Bachelor of Education (Honours) at Monash University graduating in 2016. Her particular interest is with the young child and the early learning of STEM. Simone would like to do a Masters of Education (Research) on a project relating to STEM Education in Early Years and Primary aged children.

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*Teaching to Transform* Colloquium
Participants
(Bionic Hands)

*Teaching to Transform* Workshop Participants
(PaDL Framework and Curriculum Designers)



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*Teaching to Transform: 21st Century Skills and Design Thinking in STEM Contexts*
(Enabling Team)

# Chapter 1

## *The STEM Planning and Design Learning (PaDL) Framework*

The *STEM Planning and Design Learning (PaDL) Framework* is informed by research. It has been co-designed by expert teachers from South East Asia for use in South East Asian classrooms. We wanted to create a framework that illustrated the complementary roles of planning and design learning processes at a glance, and to provide an easily understood common starting point. The PaDL Framework uses a few words and some simple symbols, to show what happens at each stage and how this affects other decisions and actions. The framework is for the use of both the teacher and the student.

Inexperienced STEM teachers and learners can follow the PaDL Framework to help them complete planning and designs in a sequence that optimizes learning. We believe the design and simplicity of the PaDL Framework will aid in communicating understanding. Improving the STEM planning, design and documentation will help ensure that the PaDL Framework will be applied consistently and correctly. By breaking down the framework into model processes, the teacher is better able to gauge the time needed for each task component and guide the learner accordingly. The teacher can also identify who they could involve and at what stage, to assist with their preparation and delivery, such as the use of guest speakers, or booking equipment.

During the *Teaching to Transform Workshop*, each participant benefited from the process of creating the PaDL Framework itself, building step-by-step. Many participants commented on the empowering nature of the task. For example, one group identified their enlightenment in terms of "STEM is participation, not observation. It is here [indicates a Design component on model]. We are learning from this designing of the frame – like the children will from design of solution" (Participant). Participants in our workshops were organised in small groups. Each group was supplied with a selection of educational models accessed from the Internet to critique. Five groups were given models aimed at teacher planning (see Table 1.1) and the remaining five groups were given models related to design learning for students (see Table 1.2). Each group was required to focus their critique on the detail *within* each model, to look in-depth at each individual component and to explore the merits of that component. After each model had been examined and critiqued in-depth, the groups then considered the broader picture by comparing the benefits *between* the models. From these *within* and *between* model critiques, each group created their own initial planning or design model. The initial models were displayed and the *within* and *between* critique was repeated to identify valuable model components for the PaDL Framework. A draft framework was created and a final *within* and *between* critique was conducted to determine the desired configuration of the PaDL Framework.

$$4 \left( \begin{array}{c} \text{Within and} \\ \text{Between} \\ \text{Critiques} \end{array} \right) \longrightarrow \begin{array}{c} \text{STEM Planning and} \\ \text{Design Learning (PaDL)} \\ \text{Framework} \end{array}$$
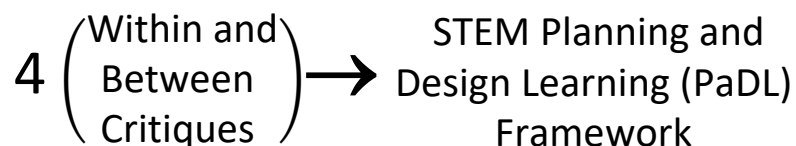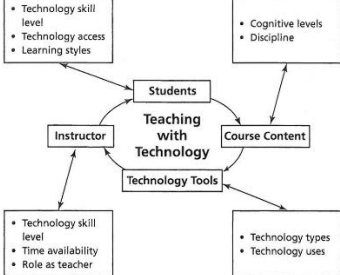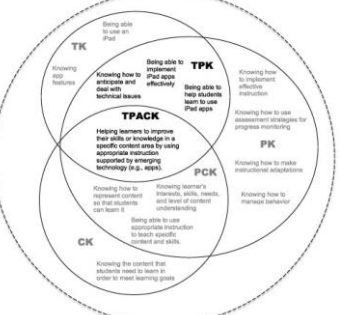
Table 1.1 Teacher Planning Models
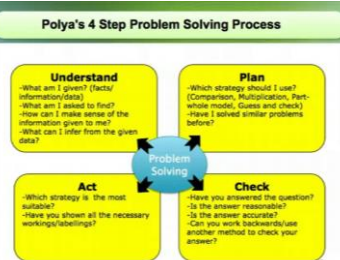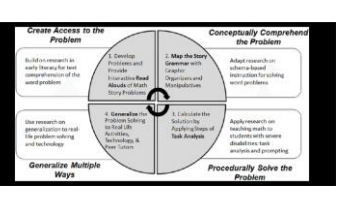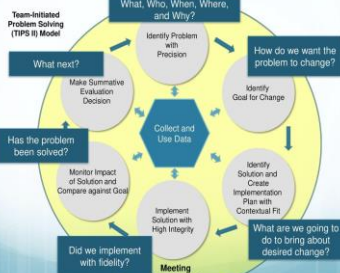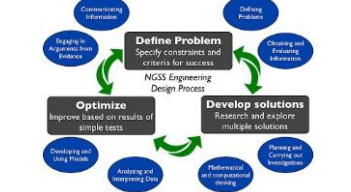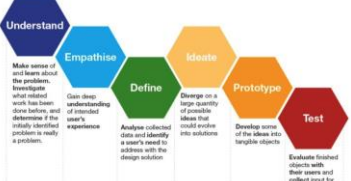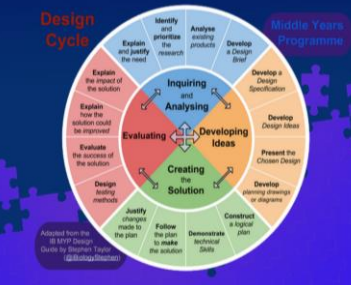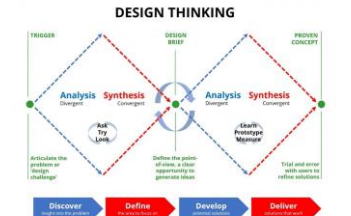
| Model | Source |
|---|---|
|  | Teaching with Technology<br>http://www.crlt.umich.edu/teaching-technology/getting-started |
|  | A TPACK model depicting the knowledge underlying preservice teachers' decisions while using iPad apps<br>https://www.citejournal.org/volume-17/issue-1-17/general/tpack-in-special-education-preservice-teacher-decision-making-while-integrating-ipads-into-instruction/ |
|  | Polya's 4 Step problem solving<br>https://www.youtube.com/watch?v=Cbw6-x8DPpQ |
|  | Conceptual model for teaching arithmetic problem solving to students<br>https://www.researchgate.net/figure/Conceptual-model-for-teaching-arithmetic-problem-solving-to-students-with-severe_fig1_316453451 |
|  | Team initiated problem solving Slide 5<br>https://slideplayer.com/slide/12026975/69/ images /6/Pick% 20a%20Data %20Packet/Set%20from% 20Scenarios%20 |

Table 1.1 Continued; Teacher Planning Models

| Model | Source |
|---|---|
|  | Conceptual framework of the math problem-solving process. https://scholarlyrepository.miami.edu/cgi/viewcontent.cgi?article=1454&context=oa_dissertations |
|  | Science and Engineering Practices https://corelaboratewa.org/theres-no-scientific-method/ |
|  | Science in Early Childhood Classrooms: Content and Process http://ecrp.illinois.edu/beyond/seed/worth.html |
|  | The difference between Science and Engineering https://imgur.com/gallery/bo1YKNc |
|  | Writing Lab Reports: Overview (https://www.trentu.ca/academicskills/resources/mathsciences_labreportoverview.php |

Table 1.2 Design Learning for Students Models

| Model | Source |
|---|---|
|  | NGSS Engineering Design Process http://workshops.sjcoe.org/Uploads/725201712345744174.pdf |
|  | What is design thinking? https://medium.com/accela-design/design-thinking-it-s-not-just-for-design-411bbd1d42bb |
|  | Design Cycle https://sites.google.com/a/scollege.cl/gr9mypdesigntech/design-cycle |
|  | Getting to grips with Design Thinking https://www.aim.com.au/blog/getting-to-grips-with-design-thinking |

The remainder of this chapter presents the PaDL Framework in terms of its two models – the Design Planning Model for Teachers, and the Design Learning Process for Students.

Design Planning Model for Teachers **+** Design Learning Process for Students **=** STEM Planning and Design Learning (PaDL) Framework

# Design Planning Model for Teachers
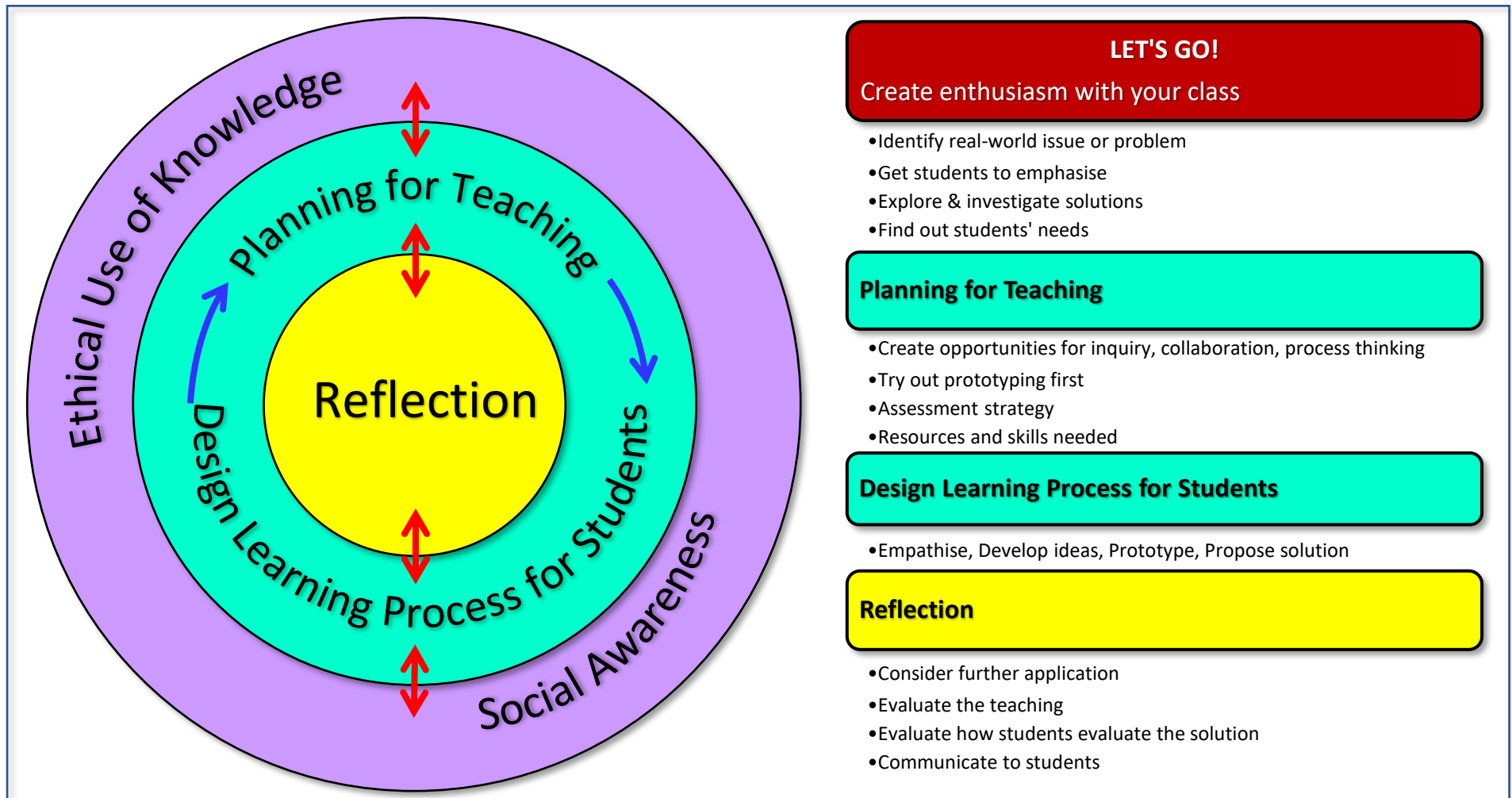


**LET'S GO!**
Create enthusiasm with your class

- •Identify real-world issue or problem
- •Get students to emphasise
- •Explore & investigate solutions
- •Find out students' needs

**Planning for Teaching**

- •Create opportunities for inquiry, collaboration, process thinking
- •Try out prototyping first
- •Assessment strategy
- •Resources and skills needed

**Design Learning Process for Students**

- •Empathise, Develop ideas, Prototype, Propose solution

**Reflection**

- •Consider further application
- •Evaluate the teaching
- •Evaluate how students evaluate the solution
- •Communicate to students

# Let's Go! Create enthusiasm with your class

This stage of the student design process is about starting your class on your learning journey. It is a celebration of what is about to come. For many classrooms, it also marks a point when there is a change in the way that teaching and learning has been done. In addition, it is an opportunity for you, the teacher to connect with your students and to explore their cultural backgrounds, local context and preferred learning styles.

# Tara na! Magpasigasig kasama ang inyong klase

Ang yugtong ito sa proseso ng pagdisenyong pang-mag-aaral ay pagsisimula ninyo sa klase sa inyong lakbay-pagkatuto. Isang pagdiriwang ito sa magaganap. Para sa iba, hudyat din ito na may pagbabago sa pamamaraan sa pagtuturo at pagkatuto. Gayundin, pagkakataon ito para sa inyo na guro na umugnay sa inyong mga mag-aaral upang tuklasin ang kanilang pinagmulan, kultura, at nais na estilo sa pagkatuto.

## Why create enthusiasm?

Planning the introduction and launch of your problem solving project and associated inquiry based learning will enable your students to better understand the goals of the activities, justify the cultural connections and enable them to become more deeply connected with the project mission. If this is not done correctly, the diminished student understanding and project ownership will reduce engagement and ongoing interest will undermine opportunities deep thinking and creativity. A great project demands an inspiring educator.

## Bakit Magpapasigasig?

Ang pagpaplano sa panimula at paglalahad ng inyong proyektong paglutas sa suliranin at kaugnay nitong batay sa pasiyasat na pagkatuto ang magpapaunawa nang mabuti sa mga mag-aaral ng mga layunin ng mga gawain, magpapatunay sa kanila ng mga ugnayang kultural, at higit na magpapalalim sa kanilang paglahok sa misyong proyekto. Kung hindi ito naisagawa nang tama, ang mag-aaral na humupa ang interes sa pag-unawa at pag-angkin sa proyekto ay makababawas sa kanilang pakikilahok at makapagpapahina sa taglay na kawilihan para sa mga pagkakataon tungo sa malalim na pag-unawa at pagkamalikhain. Sa isang natatanging proyekto kailangan ang mapagsigasig na guro.

## How to create enthusiasm?

You need to explain to students that you are challenging them in new and unfamiliar ways. Do not rely on explicit clues, rote memory or hidden answers. Instead, provide scaffolding and opportunities to help students make sense of where the project will go and what they need to learn. Instil a sense of purpose, build passion and drive. Find how to interest and engage your students. Prepare your students to embrace frustration, mistakes and blunders. Be open to questions from your students.
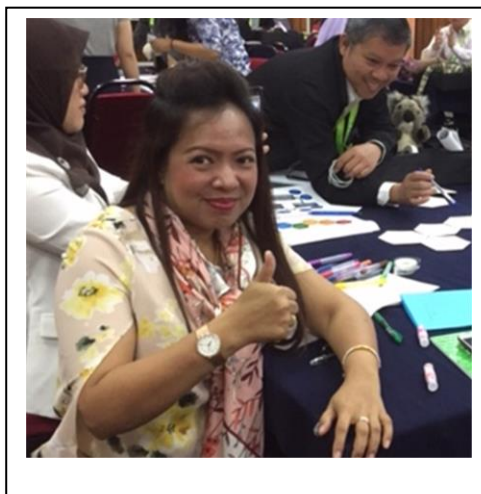


## Paano Magpapasigasig?

Kailangan ninyong ipaliwanag sa inyong mga mag-aaral na hinahamon ninyo sila sa bago at di-karaniwang pamamaraan. Huwag manalig sa mga metodong tuwirang pahiwatig, pangmemorya o nakubling tugon. Sa halip, magkaloob ng *scaffolding* (mga teknik na papaunlad/progresibo na magpapataas sa pag-unawa ng mga mag-aaral) at mga pagkakataong na tutulong sa kanila na maging lohikal sa patutunguhan ng proyekto at kung ano ang kailangan nilang matutuhan. Ikintal ang pagkakaroon ng layunin, magpasigasig, at magpasigla. Alamin kung paano pupukawin ang kanilang interes at kawilihan. Ihanda silang tumanggap ng mga kabiguan at kamalian. Maging bukas sa mga tanong ng inyong mga mag-aaral.

## Connections: Let's Go >> Ethical and Social Awareness

Your class is enthusiastic! The students are excited to learn and to meet the challenge. But you will need to help your students contain their excitement and to work together respecting each other and the research process.

## Kaugnayan: Tara! >> Kamalayang Etikal at Sosyal

Masigasig ang inyong klase! Sabik silang matuto at tumanggap ng hamon. Subalit kakailanganin ninyong mapanatili ang kanilang kasabikan at magkakasamang gumawa nang may paggalang sa isa't isa sa proseso ng pananaliksik.

# What is Ethical use of knowledge and Social Awareness?
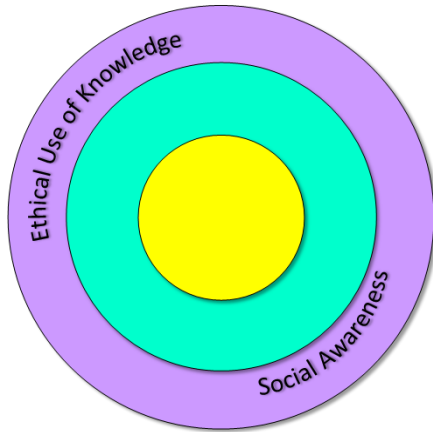
In this step you need to consider how to inform students of the moral decisions they will make as they collect and use evidence, and the problems of falsification of data. It is necessary to be sceptical and open to alternative explanations. You need to help students consider and respond to the ethical and social norms of behaviour as they work in groups and share learning ideas.

## Ano ang mabuting paggamit ng kaalaman at kamalayang sosyal?

Sa hakbang na ito, kailangan ninyong isaalang-alang kung paano turuan ang mga mag-aaral ng tamang pagpapasiya na kanilang gagawin sa kanilang pangangalap at paggamit ng mga patunay, gayundin, ang mga suliranin sa pandaraya sa mga datos. Mahalagang maging iskeptikal at bukas sa mga alternatibong paliwanag. Kailangan silang tulungan na isaalang-alang at tumugon sa mabuti at panlipunang pamantayan ng mga gawi habang sila ay gumagawa nang pangkatan at nagbabahaginan ng mga ideya.

## Why have ethical and social awareness?

If your students have a social awareness, they can empathize with the ideas of others, and engage in positive classroom behaviours – thus a classroom is created with a focus on learning. Students with strong social awareness are able to communicate with their peers and resolve conflicts when they arise.

## Bakit kailangan ng kamalayang etikal at sosyal?

Kung ang inyong mga mag-aaral ay may kamalayang panlipunan, magiging bukas sila sa pag-unawa sa mga ideya ng iba at lalahok sa mga gawing positibo sa klase –kaya, nilikha ang isang klasrum nang nakatuon sa pagkatuto. Ang mga mag-aaral na may matibay na kamalayang panlipunan ay nakikipag-ugnay sa kanilang mga kamag-aral at nilulutas ang mga hindi pagkakaunawaan kung magkaroon man.

## How to behave ethically and with social awareness?

Ethical behaviour involves demonstrating respect for moral principles that include honesty, fairness, equality, dignity, and diversity.

Students who carefully consider what their peers want, and then plan to communicate with them in a way that is intended to meet that need as being socially aware. Being socially aware is a natural response to people, taking their situation and needs into account as much as possible.
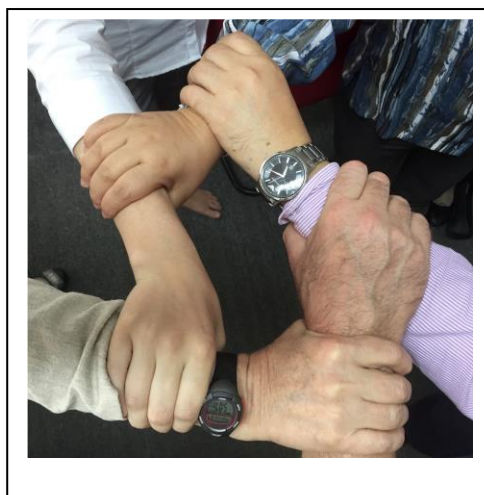


## Paano kumilos nang mabuti at may kamalayang panlipunan?

Ang mabuting pag-uugali ay kinapapalooban ng pagpapakita ng paggalang sa mga pamantayan sa kabutihan gaya ng katapatan, pagkamakatarungan, pagkakapantay-pantay, karangalan, at pagkakaiba-iba.

Ang mga mag-aaral na maingat na isinasaalang-alang ang nais ng kanilang kamag-aral, at nagpaplano sa pakikitungo sa paraang matutugunan ang pangangailangang ito ay pagkakaroon ng kamalayang sosyal. Ang pagkakaroon ng kamalayang panlipunan ay likas na tugon sa tao, hangga't maaari pagsasaalang-alang sa kanilang sitwasyon at pangangailangan.

## Connections: Ethical use of knowledge and Social awareness >> Planning for teaching and Design learning process for students

After exploring the ethical and social learning's you want to develop in your students, begin thinking of the content you can teach to develop ethical and social awareness. How will you develop these skills in a mathematics and science focused activity?

## Kaugnayan: Mabuting paggamit ng kaalaman at kamalayang sosyal>>Pagpaplano sa Pagtuturo at Prosesong Pagkatutong Padisenyong Pangmag-aaral

Pagkatapos maunawaan ang mga kaalamang etikal at sosyal na nais ninyong makintal sa inyong mga mag-aaral, magsimulang mag-isip ng mga paksa/nilalamang maaari ninyong ituro upang kanilang matutuhan ang kamalayang etikal at sosyal. Paano ninyo malilinang ang mga kasanayang ito sa mga tuong gawain sa matematika at agham?
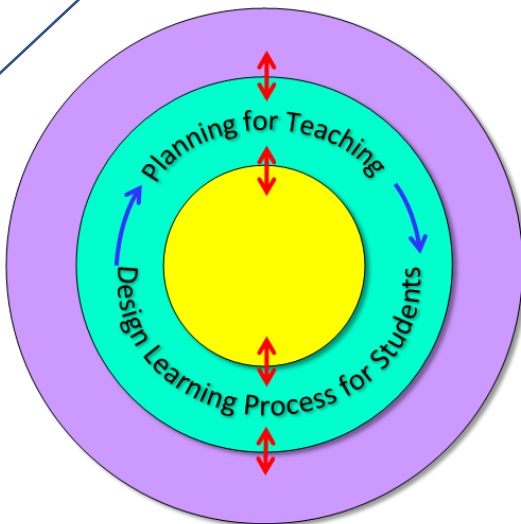
# What is planning for teaching and Design learning process for students?

In this step, you incorporate your ideas about creating enthusiasm, a real-world problem or issue for students, connection to the curriculum, and plan the sequence of learning activities, scaffolding, resources, and assessment. The sequence of learning activities will lead students through the Design learning process (empathising, …, proposing solution). Get students to consider issues like ethical use of knowledge, implications and consequences of solutions, how to work cooperatively in groups, how to conduct inquiry and develop other 21st Century Skills.

# Ano ang pagpaplano sa pagtuturo at prosesong pagkatutong pagdisenyong pangmag-aaral?

Sa hakbang na ito, isama ninyo ang inyong mga ideya sa pagpapasigasig sa klase, ang mga suliranin at isyung tunay sa mundo para sa mga mag-aaral, kaugnayan nito sa kurikulum, at planong pagkasunod-sunod ng mga gawain, *scaffolding,* mga kagamitan, at pagtataya. Ang serye ng mga gawaing pagkatutong ito ang magdadala sa mga mag-aaral sa prosesong pagkatutong pagdisenyo (pag-empatiya,...,pagpanukala ng solusyon). Ipasaalang-alang sa mga mag-aaral ang mga isyung gaya ng mabuting paggamit ng kaalaman, mga implikasyon at kahihinatnan ng mga solusyon, paano kooperatibong makilahok sa mga gawaing pangkatan, paano gumawa ng pagsisiyasat, at malinang ang iba pang mga ika-21 siglo kasanayan.

# Why students use the Design learning process?

This Design learning process model for learning is a particular pedagogical approach which will develop students' collaborative, problem solving, 21st Century skills, while learning and applying their disciplinary knowledge and skills.

# Bakit gagamit ang mga mag-aaral ng Prosesong Pagkatutong Pagdisenyo?

Ang modelong prosesong pagkatutong pagdisenyo ay isang natatanging dulog pedagohikal na lilinangin sa mga mag-aaral ang pagiging kolaboratibo, paglutas ng mga suliranin, mga ika-21 siglo kasanayan habang natututuhan at nilalapat ang kanilang pandisiplinang kaalaman at mga kasanayan.

# How to plan for teaching?

Use the unit plan template (see examples) to plan for a 6 weeks unit on a topic. Plan with other subject teachers teaching the same class Incorporate *Common Core Regional Learning Standards* from other subjects. Have fun trying out the prototyping and other activities first before teaching. Incorporate activity ideas from the examples in this booklet.

# Paano magplano para sa pagtuturo?

Gamitin ang padron ng planong pang-yunit (tingnan ang mga halimbawa) sa pagpaplano para sa anim na linggong yunit sa isang paksa. Magplano kasama ang mga guro sa iba pang mga asignatura na nagtuturo sa parehong klase, isama ang *Common Core Regional Learning Standards* ng mga ito. Gawing kasiya-siya ang pagsubok sa mga huwaran/prototipo at iba pang mga gawain bago ang pagtuturo. Ilakip ang mga ideya sa gawain mula sa mga halimbawa sa libretong ito.
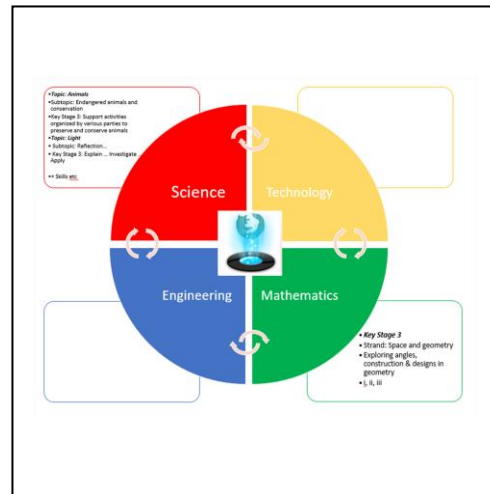
# Connections: Planning for teaching & Design learning process for students >> Reflection

After each lesson, reflect on the strengths and areas for improvement of the activities, resources, instructions, scaffolding, and assessment. Also reflect on your own planning process, and the students' design learning process.

# Kaugnayan: Pagpaplano para sa Pagtuturo at Prosesong Pagkatutong Pagdisenyong Pangmag-aaral>>Pagninilay

Pagkatapos ng bawat aralin, magnilay sa mga kalakasan at bahaging kailangan ng pag-unlad sa mga gawain, kagamitan, pamamaraan sa pagtuturo, *scaffolding*, at pagtataya. Gayundin, pagnilayan ang inyong sariling proseso ng pagpaplano, at ang prosesong pagkatutong pagdisenyong pangmag-aaral.
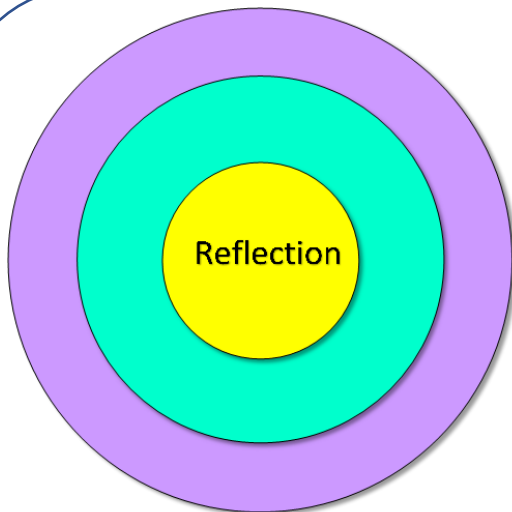
# What is Reflection?

Through-out all stages of planning, you must consider your overall goal to ensure you meet the *Common Core Regional Learning Standards*.

Questions you can ask yourself during the planning are: Are the students productively engaged and how do I know they are? What additional assistance, support, and/or resources will further enhance this lesson? What can I do differently, and why do I need to have options?

# Ano ang Pagninilay?

Sa lahat ng yugto ng pagpaplano, kailangan ninyong isaalang-alang ang inyong pangkalahatang mithiin upang matiyak na inyong matatamo ang *Common Core Regional Learning Standards.*

Ang mga maaaring tanong ninyo sa inyong sarili habang nagpaplano ay: ang mga mag-aaral ba ay produktibong nakilahok, at kung magkagayon, paano ko ito malalaman? Ano pa ang mga kailangan kong tulong, suporta, at/o kagamitan para higit pang mapahusay ang araling ito? Ano ang magagawa kong naiiba, at bakit kailangan ko ng mga pamimilian?

# Why reflect?

Teachers who explore their own planning and teaching through reflection develop changes in attitudes and awareness which benefits their professional growth as teachers, as well as improve the learning support they provide their students.

By reflecting teachers begin to exercise control and open up the possibility of transforming their everyday classroom life.

# Bakit kailangang magnilay?

Ang mga gurong sinusuri ang kanilang sariling pagpaplano at pagtuturo sa pamamagitan ng pagninilay ang magpapabago sa kanilang pag-uugali at pag-unawa na tutulong sa kanilang propesyonal na pag-unlad, gayundin, magpapahusay sa kanilang suportang paglinang na ipinagkakaloob sa kanilang mga mag-aaral.

Sa pamamagitan ng pagninilay, nagsisimulang magkaroon ng kontrol ang mga guro at nagiging bukas sa maaaring pagbabago sa kanilang pang-araw-araw na buhay sa loob ng kanilang klasrum.

# How to reflect?

How can we help students to learn, create, connect, communicate ideas and concepts better? How can we also help students reflect on their own learning process?

The teacher needs to move beyond "how to" questions and asking "what" and "why" questions. Asking "what and why" questions give teachers power over our teaching.

# Paano magnilay?

Paano natin matutulungan ang mga mag-aaral na matuto, lumikha, umugnay, maglahad nang mahusay ng kanilang mga ideya at konsepto? Paano rin natin sila matutulungan na magnilay sa kanilang sariling proseso ng pagkatuto?

Kailangang lumabas ng guro sa mga tanong na "paano" at itanong ang "ano" at "bakit". Ang pagtatanong ng "ano at bakit" ang magbibigay sa mga guro ng kapangyarihan sa pagtuturo.

# Iteration and making the process your own

The *Design Planning Model for Teachers* is iterative and requires multiple cycles, where the teacher has to go back to the previous step or even back to the first step, in order to go forward. This process is only a suggestion and, in the end, you have to make the process your own and adapt it to your style and your work. It is about your way of thinking and working.

# Pag-uulit at pag-angkin sa proseso

Nauulit at may maraming siklo ng pamamaraan ang *Modelong Pagpaplanong Pagdisenyo para sa mga Guro*, na kailangang bumalik ang guro sa nakaraang hakbang o kahit sa nauna para magpatuloy. Panukala lamang ang prosesong ito at sa huli, kailangan ninyo gawing inyo o angkinin ang proseso at iangkop ito sa inyong sariling estilo at gawain. Ito ay hinggil sa inyong pamamaraan ng pag-iisip at paggawa.
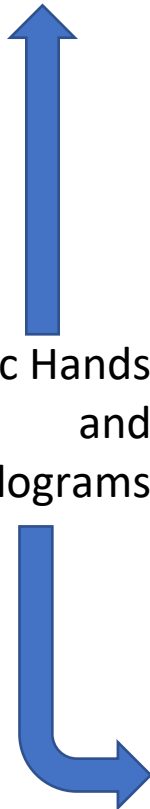
Creating Bionic Hands
and
Holograms

# Design Learning Process for Students

**Empathising**
- Define the Problem
- Diagnose Issue
- Analyse Needs

**Developing Design Ideas**
- **STEM Thinking and Knowledge** - Convergent & Divergent Thinking, Maths & Computational Thinking, Scientific Inquiry, Technical Skills
- **Values** - Social Awareness, Ethical Use of Knowledge

**Prototyping/ Modelling**
- Test & Improve
- Evaluate
- Trial & Error

**Proposing Solution**
- Present & Communicate
- Examine Consequences
- Reflect on the Process

Every great design begins with a great **DREAM** or a great *PROBLEM*.

DESIGNING is so easy. That's why it is so *HARD*.

Prototyping is a way you **talk** to your *IDEAS*.

If the *PLAN* doesn't work, change the plan but never the **GOAL.**

**Empathising**

"Empathy is seeing with the eyes of another, listening with the ears of another and feeling with the heart of another." – Alfred Adler

"Ang empatiya ay pagtingin kasama ang pagtingin ng iba, pakikinig kasama ang pakikinig ng iba, at pagdama kasama ang pagdama ng iba."– Alfred Adler

# What is Empathising?

The empathy stage of the student design process is about you developing a human-centred view of problem solving. Observe other people, examining their context and listening to their needs and requirements. This will help you to become more deeply empathic and understanding. A great project demands a rich empathy experience.

# Ano ang Pag-empatiya?

Ang yugtong empatiya sa prosesong pagdisenyong pang-mag-aaral ay hinggil sa paglinang sa inyo sa pantaong-tuon na pagtingin sa paglutas ng mga suliranin. Suriin ang ibang tao, siyasatin ang kanilang pinagmulan at dinggin ang kanilang pangangailangan. Makatutulong ito sa inyo upang magkaroon nang higit na malalim na empatiya at pag-unawa. Sa isang natatanging proyekto kailangan ang may mayamang karanasan sa pag-empatiya at pag-unawa.

# Why include empathy?

The empathy stage puts other people at the start and heart of any planning activity or research project. This human-centred approach ensures that your design and proposed solution is anchored in the real-world. It will help you to make the right decisions and avoid design failure when solving problems. Do not guess what other people need without first listening to them. A lack of empathy will contribute to design failure. Without empathy, there is no solution.

# Bakit kailangan isama ang empatiya?

Sa yugtong empatiya inuuna at dinadama ang ibang tao sa anumang gawaing pagpaplano o proyektong pananaliksik. Tinitiyak sa dulog na pantaong-tuon na ito na ayon sa tunay na mundo ang inyong disenyo at mungkahing solusyon. Makatutulong ito sa tamang pagpapasiya at pag-iwas sa bigong paglutas ng mga suliranin. Huwag ipagpalagay ang nais ng ibang tao nang hindi sila inuunang pakinggan. Ang kakulangan sa empatiya ang bibigo sa disenyo. Kung walang empatiya, walang solusyon.

## How to empathise?

There are many different tools and techniques for this stage; from interviewing to empathy maps. They all require you listen and observe people. To do this, you may need to challenge yourself, examine any biases and ask better questions. Explore the heart not just the head. Your teacher can help you to cultivate a sense of curiosity, and help get you out of your usual comfort zone.

## Paano magpakita ng empatiya?

Maraming iba't ibang kagamitan at teknik sa bahaging ito; mula sa pakikipanayam hanggang sa pagmapa ng empatiya. Sa lahat ng ito, kailangan ng inyong pakikinig at pagsusuri sa mga tao. Kailangan ninyong hamunin ang inyong sarili, suriin ang anumang pagkiling at magtanong ng mga angkop na tanong upang maisagawa ito. Pakiramdaman ang puso hindi lamang ang isip. Ang inyong guro ay makatutulong sa inyo na linangin sa inyo ang pagnanais na umunawa at makalaya sa nakagawian.

## Transition: Empathising >> Developing Design Ideas

Only when you have combined all the collected insights can you begin to synthesize them into an outline and define the problem. It ensures that your prototype or model puts people into the centre of the solution and does not contribute to an undesirable outcome.

## Transisyon: Pag-eempatiya >> Paglinang sa Pagdisenyo ng mga ideya

Masisimulan ninyo ang pagbuo ng balangkas at pagtukoy sa suliranin sa pagsasama-sama lamang ng inyong mga nakalap na kabatiran/kaalaman. Tinitiyak nito na ang solusyon sa inyong prototipo o modelo ay nakatuon sa tao at walang masamang kahihinatnan.
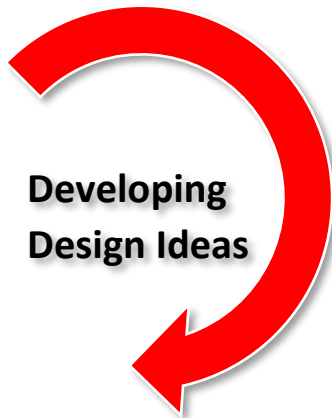
## What is Developing Design Ideas?

In this step, you brainstorm many different ideas, based on the problem, issue and needs found in the previous step. Go wild with different ideas! Write or draw them out. Link different things together to create new ideas. Ideas will push you to the next step of prototyping and modelling. Use your social awareness and ethical use of knowledge.

**Developing Design Ideas**

## Ano ang Paglinang sa Pagdisenyo ng mga Ideya?

Sa hakbang na ito, paglilimian ninyo ang maraming magkakaibang ideya, batay sa suliranin, mga isyu, at mga pangangailangang natuklasan sa mga nakaraang hakbang. Maging malikhain sa magkakaibang ideya! Isulat o iguhit ninyo ito. Iugnay sa ibang pang mga bagay upang makalikha ng mga bagong kaalaman/ideya. Ang mga ideyang ito ang magdadala sa inyo sa susunod na hakbang na pagpoprototipo o pagmomodelo. Gamitin ang inyong kamalayang sosyal at mabuting paggamit ng kaalaman.

## Why develop design ideas?

You need to think creatively and generate the widest possible range of ideas from which you can choose from (this is called divergent thinking). You will start to narrow down your options to find the best solution in the next step, through testing your prototypes or models (convergent thinking).

## Bakit lilinangin ang pagdisenyo ng mga ideya?

Kailangan ninyong maging malikhain sa pag-iisip at bumuo posibleng lawak ng mga ideya/kaalaman na inyong mapamimilian (tinatawag itong *divergent thingking*). Sumunod na hakbang, sisimulan ninyo ang pagbawas sa inyong pamimilian upang malaman ang pinakaangkop na solusyon, ito ay sa pamamagitan ng pagtataya/pagsusuri sa inyong mga prototipo o modelo (*convergent thingking*).

## How to develop design ideas?

Combine your understanding and knowledge in different subjects (Mathematics, Science, Technology) to new thinking about how to solve the problem or issue.

Use your conscious and unconscious mind, logical thinking, computational thinking, and imagination.

Building things (prototyping) can be a way to help you come up with new ideas. Other ways: Brainstorm, MindMap, Role-Play, Draw.
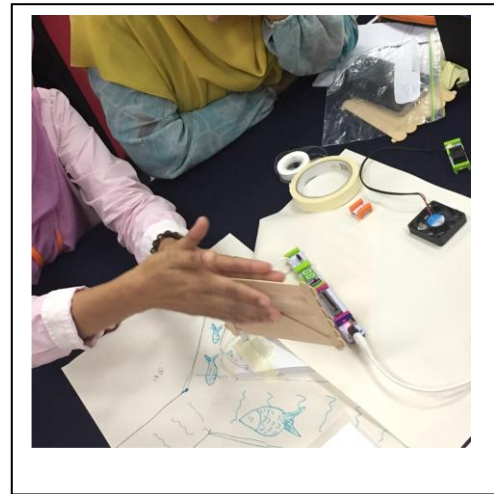
## Paano ang lilinangin ang pagdisenyo ng mga ideya?

Pagsamahin ang inyong pag-unawa at kaalaman sa magkakaibang mga asignatura (Matematika, Agham, Teknolohiya) sa bagong pagtingin hinggil sa paano lumutas ng problema o isyu.

Gamitin ang inyong malay at di-malay na kaisipan, lohikal na pag-iisip, patayang pagsusuri, at imahinasyon.

Ang pagbuo ng mga bagay (pagprototipo) ay maaaring maging isang daan upang matulungan kayong makadisenyo ng mga bagong kaalaman/ideya: Iba pang pamamaraan: *Brainstorm, Mind Map, Role-Play*, Pagghuhit.

## Transition: Developing Design Ideas >> Prototyping / Modelling

After coming up with all the ideas, you need to carefully choose some ideas to prototype (choose e.g., most logical, most liked by people, most unexpected). Use these **different ideas rather than just one idea** everyone agrees with.

## Transisyon: Paglinang ng Pagdisenyo ng mga ideya>>Pagpoprototipo/Pagmomodelo

Pagkatapos magdisenyo ng mga ideya/kaalaman, kailangan ninyong maingat na pumili ng ilang mga ideya na magiging prototipo (pumili ng halimbawa, pinakalohikal, pinakagusto ng tao, pinaka hindi inaasahan). Gamitin ang iba't **ibang mga ideyang ito sa halip na isa lamang ideya** na sinang-ayunan ng lahat.
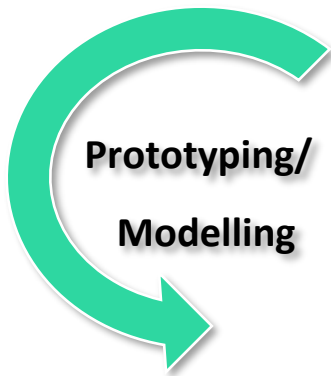
# What is Prototyping/ Modelling?

The modelling stage of the student design process is about the construction of a unique model that solves a real-world problem. Your final model or prototype is a representation of a proposed solution. It should clearly illustrate what the solution could look like, how it works or how it could be used. A model does not need to be the same size or even made of the same materials as the proposed solution.

**Prototyping/ Modelling**

There are many different tools and techniques for this stage; from ideation and testing to hands-on construction. They all require you to plan using your mind, look with your eyes, build with your hands and listen to everybody else's ideas and questions. The final model you design and build is a display of your imagination, creativity and playful tinkering.

# Ano ang Pagprototipo/Pagmomodelo?

Ang yugtong ito ng prosesong pagdisenyong pangmag-aaral ay hinggil sa pagbuo ng tanging modelo na lulutas sa suliraning tunay sa mundo. Ang inyong pinal na modelo o prototipo ay representasyon ng isang panukalang solusyon. Dapat ipinakikita nito nang malinaw ang magiging anyo ng solusyon, paano ito makatutulong, at paano ito maisasagawa. Ang modelong ito ay hindi kailangang maging katulad ng sukat o pareho sa mga materyal ng sa panukalang solusyon.

Maraming iba pang mga kagamitan o teknik para sa yugtong ito; mula sa pag-iisip ng mga ideya at pagtataya hanggang sa tuwirang pagbuo nito. Lahat ng ito ay nangangailangan ng pagpaplano gamit ang inyong isip, pagsusuri ng inyong mga mata, pagbuo gamit ang inyong mga kamay, at pakikinig sa mga ideya at tanong ng lahat. Ang pinal na modelong inyong dinisenyo at binuo ay isang pagpapamalas ng inyong imahinasyon, pagkamalikhain, at masiglang pag-iimbento.

# Why build a prototype model?

A great project demands a curious disposition, a compelling modelling experience and an interesting prototype or final model that can be designed, built then shared with others. To do this, you all need to generate and build upon ideas from your imaginations and personal experiences. Your model can represent the behaviour of a solution, or test the solution in different ways. It is something that you can showcase and learn about. It is something to share and build from. The modelling process rapidly moves from an initial paper design towards a working solution, physical 3D model or prototype, with idea checking along the way.

# Bakit kailangan bumuo ng modelong prototipo?

Sa natatanging proyekto kailangan ang mapanuring pagtingin, ang mapanghikayat na karanasan sa pagbuo ng modelo at makapukaw interes na prototipo o pinal na modelo na maaaring idisenyo, buoin, at ibahagi sa iba. Para maisagawa ito, kailangang ninyong lumikha at bumuo mula sa mga ideya sa inyong imahinasyon at personal na karanasan. Ang inyong modelo ay maaaring maglarawan ng katangian ng isang solusyon o tayahin ito sa ibang pamamaraan. Ito ay isang bagay na inyong maipagmamalaki at matututuhan. Ito ay maibabahagi at mapagbabatayan. Mabilis ang proseso ng pagdidisenyo mula sa paggawa ng inisyal na papel ng pagdisenyo tungo sa pagbuo ng solusyon, at hanggang maging pisikal na modelong 3D o prototipo, na habang umuusad ang proseso ay sinusuri ito.

## How to create new knowledge?

This involves you constructing ideas and models. You need to use the inquiry learning approach, and you must embrace failure and learn from your mistakes. It is important that you allow yourself the chance to fail – so that you can learn. Moving from idea generation to hands-on action and construction, requires mental activity that constructs new knowledge and objects. To do this, you must collaborate in groups and draw your plans, communicate with others to explore alternative ideas and build new knowledge.

## Paano bumuo ng bagong kaalaman?

Kinapapalooban ito ng inyong pagbuo ng mga ideya at modelo. Kailangang ninyong gumamit ng dulog na pagkatutong pasiyasat, at dapat ninyong tanggapin ang kabiguan at matuto sa inyong pagkakamali. Mahalagang hayaan ninyong magkaroon kayo ng pagkakataong mabigo –upang kayo ay matuto. Ang sa paglikha ng mga ideya tungo sa pagsasagawa, at pagbuo, kailangan ng aktibong pag-iisip na lilikha ng bagong kaalaman at mga bagay. Upang maisagawa ito, kailangan ninyo ng pangkatang pagsangguni at pagpaplano, pakikipagtulungan sa iba upang tuklasin ang mga alternatibong ideya at pagkabuo ng bagong kaalaman.

## Transition: Prototyping/ Modelling >> Proposing Solution

Your teacher can help you by supplying model construction kits, cultural contexts and by cultivating a sense of playful tinkering and innovation with strategic questioning and deep thinking. You must work as a group, find the courage to explore with your hands and with your friends, not just from memory, and certainly not from a textbook.

## Transisyon: Pagpoprototipo/Pagmomodelo >> Pagpapanukala ng Solusyon

Matutulungan kayo ng inyong guro sa pamamagitan ng pagbibigay ng mga kit para sa inyong pagbuo ng modelo, mga kaugnay na kontekstong pangkultura, at sa paglinang sa masiglang pag-iimbento, inobasyon na may estratehikong pagtatanong at malalim na pag-iisip. Kailangan ninyong gumawa nang pangkatan, at maging matatag sa sariling pagtuklas at kasama ang inyong mga kaibigan, na hindi lamang mula sa kaisipan at lalo na sa aklat.

## What is Proposing Solution?

In this step you get feedback, evaluate your prototype or model, consider the consequences, and come up with your groups' solution to solve the problem. You need to finalise your prototype or model into a model that is realistic and as good as possible given the time frame and resources. You must also decide how to present your solution to your audience, to convince them that your solution is the best possible.

## Ano ang  Pagpapanukala ng Solusyon?

Sa hakbang na ito, tatanggap kayo ng feedback, tatayahin ninyo ang inyong prototipo o modelo. Isaalang-alang ang mga maaaring kahihinatnan at pangkatang bumuo ng inyong solusyon sa suliranin. Kailangan ninyong isapinal ang inyong prototipo o modelo upang maging makatotothanang huwaran at maayos hangga't maaari sa ibinigay na takdang panahon at mga kagamitan. Kailangan din ninyong pagpasiyahan kung paano ninyo ito ilalahad sa inyong mga tagapakinig upang mahikayat sila na ito ang pinakanararapat na solusyon.

## Why propose a solution?

To connect your model/ prototype back to the context or problem, and check if it is a good solution.

To communicate your model/ prototype to other stakeholders.

To reflect on the entire design process and make improvements.

## Bakit kailangang magpanukala ng isang solusyon?

Ito ay upang iugnay ang inyong modelo/prototipo sa konteksto o suliranin, at masuri kung ito ay isang mabuting solusyon.

Upang mailahad ang inyong modelo/prototipo sa iba pang mga stakeholder.

Upang mapagnilayan ang buong proseso ng pagdisenyo at mapaunlad pa ito.

## How to propose a solution?

Think of the **different components** of your prototype/ model – how can you improve them based on the context?

**Evaluate** - Does your prototype/ model solve the problem? What are the consequences of the model when it is used?

**Communicate** – How can you use words, diagrams, graphs and other media to present your solution to convince others?

## Paano bumuo ng bagong kaalaman?

Isipin ang **ibang bahagi** ng inyong prototipo/modelo – paano ninyo mapauunlad ito batay sa konteksto?

**Tayahin** – Nalutas ba ang suliranin ng inyong prototipo/modelo? Ano ang mga kahihinatnan kung gagamitin ang modelong ito?

**Paglalahad** – Paano ninyo gagamitin ang mga salita, diyagram, grapiko, at iba pang media upang ilahad ang inyong solusyon at manghikayat sa iba?

## Iteration and making the process your own

This process can go in many cycles and sometimes you have to go back to the previous step or even back to the first step, in order to go forward. This process is only a suggestion and, in the end, you have to make the process your own and adapt it to your style and your work. It is about your way of thinking and working.

## Pag-uulit at pag-angkin sa proseso

Maaaring isagawa sa maraming siklo ng pamamaraan ang prosesong ito at minsan kailangang bumalik sa nakaraang hakbang o kahit sa nauna para magpatuloy. Panukala lamang ang prosesong ito at sa huli, kailangan ninyong gawing inyo o angkinin ang proseso at iangkop ito sa inyong sariling estilo at gawain. Ito ay hinggil sa inyong pamamaraan ng pag-iisip at paggawa.

PaDL Framework: -
Design in action
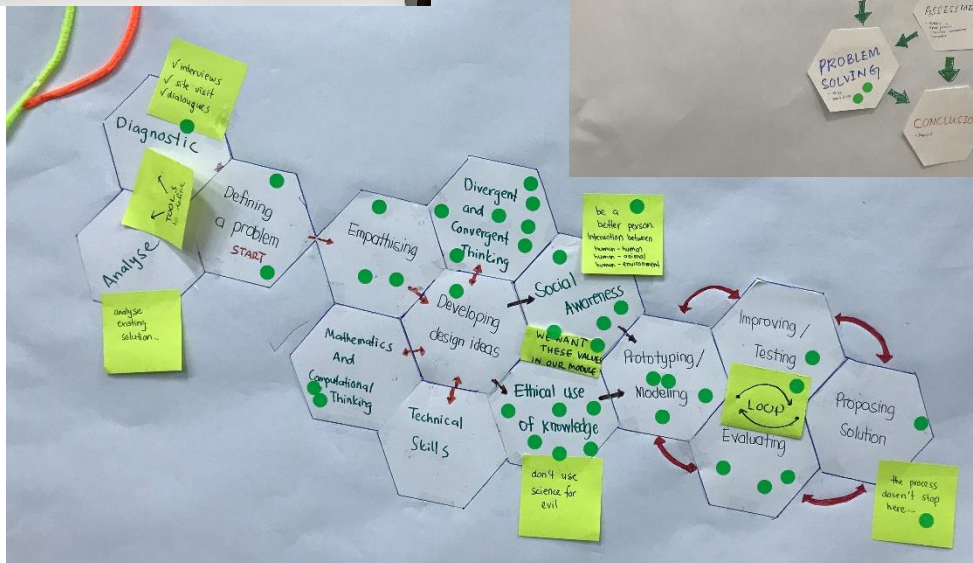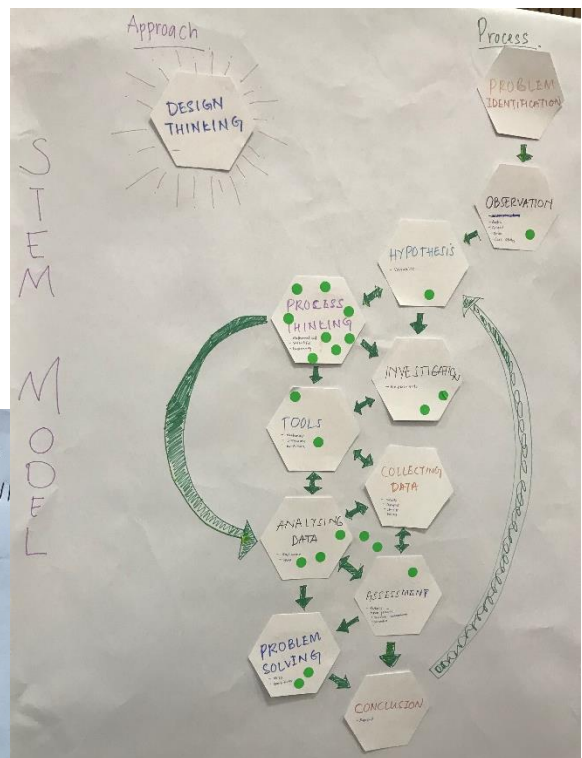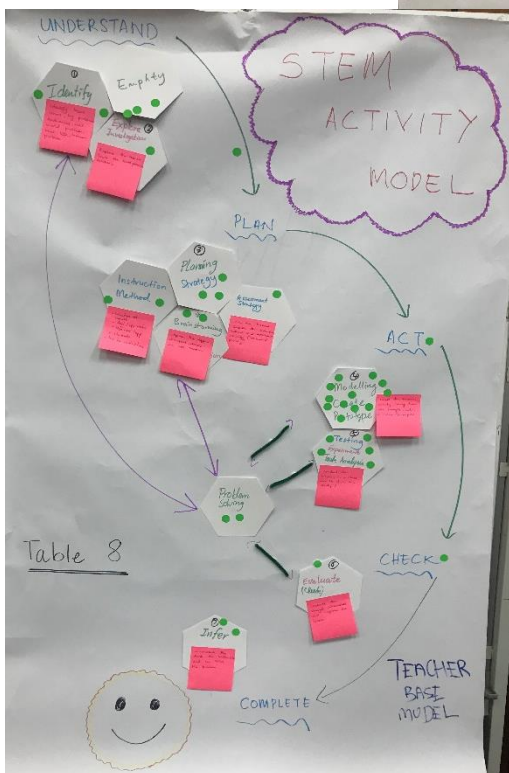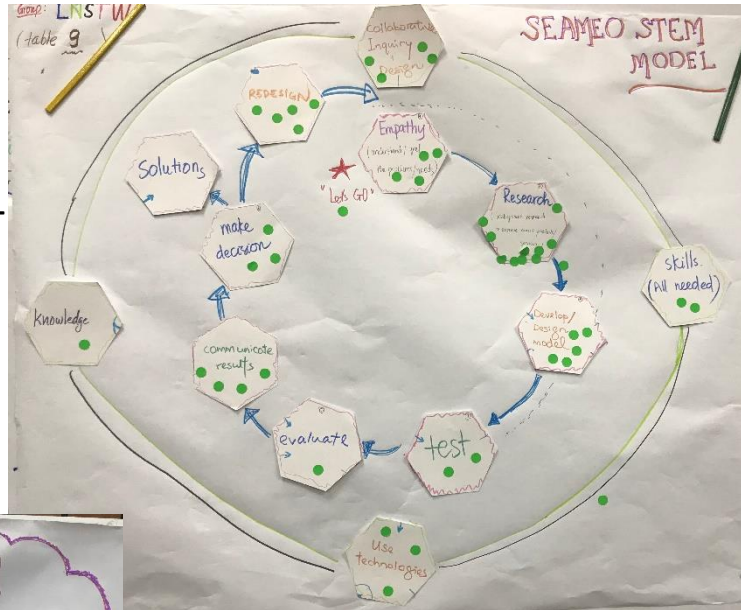
# Tiger conservation in South East Asia



Over one-third of tiger conservation sites are severely at risk of losing their wild tigers - the majority of which are in Southeast Asia. Many of these areas lack basic plans for effective management. There is poor data collection and limited information about wild tiger populations.

Government reports on the current status of national tiger recovery identify some best practice strategies and highlight many challenges.

The key barriers to wild tiger recovery in Southeast Asia include poaching, lack of capacity, habitat loss and limited funding. Some countries have shown that despite these challenges, population recovery is possible alongside sustaining community livelihoods.

To protect the remaining wild tiger populations, it is important for local communities to commit to changing the current situation, implement breeding recovery plans and improve data collection.

Modified from: https://www.wwfindia.org/?18081/Urgent-attention-needed-for-global-tiger-recovery-efforts

**Have your students undertake a design challenge to obtain better data about wild tiger populations.**

This scheme of work was developed by: Ahmad Syihan Fadzli bin Khairi, Jerico F. Balmes, Koua Xiong, Mohd Muzaitulakmam bin Abdul Mutalib, Radin Muhd Imaduddin bin Radin Abdul Halim, Songka Keochansy.

# Scheme of Work Outline

| Scheme of Work Title: | Time allocation | Year Level |
|---|---|---|
| **Tiger conservation in South East Asia** | **6 weeks** | **Key Stage 2** |

## Unit Overview

The students learn about the human-tiger conflict in South East Asia, and help current scientists to improve their monitoring system to survey the tiger population and monitor their vital statistics such as height, length, weight and blood pressure.

The problems with the current system:
1. The cages in use are big and heavy thus challenging to transport
2. Requires manual intervention to tag the tiger, which compromises the safety of humans involved if the anaesthesia goes wrong.
3. Does not collect height & length, weight and blood pressure data.

**Pre-requisite knowledge:**
1. Measuring
2. Endangered animals
3. Animal basic needs: water, food shelter
4. Basic material science

**Useful Resources**
1. World Wildlife Fund (WWF) resources on the Internet
2. Dialogue with experts from WWF Malaysia chapter and Malaysia Nature Society.
3. Newspaper clippings
4. National geographic videos
5. Statistics from reliable tiger conservation organizations or government estimates.

**Assessments**

1. Refer to weekly teaching plan.

## Links to Curriculum

| TOPIC CONTENT |
|---|
| This topic includes: (by referring to *Common Core Regional Learning Standards*)<br><br>1. Quantity and Measurement (Key Stage 1)<br>2. Pattern and Data Representation (Key Stage 1)<br>3. Measurement of Volume in relation to surface area (Key Stage 2, strand measurement and relations)<br>4. Data handling and graphs (Key Stage 2)<br>5. Body parts of animal (Key stage 1& 2)<br>6. Basic need of animals |

**ACHIEVMENT OUTCOME 1:**

| Key knowledge | Key skills |
|---|---|
| 1. Exploring the physical characteristics of a tiger<br>2. Realisation of decreasing number of tigers in Asia | 1. Observation<br>2. Computational and graphing skills.<br>3. Measuring skills |

**ACHIEVMENT OUTCOME 2:**

| Key knowledge | Key skills |
|---|---|
| 1. Designing a new cage to operate capture-tag-monitor.<br>2. Utilising electrical circuitry to obtain captured tiger vital health statistics.<br>3. Understanding material properties to build the new cage. | 1. Using geometry skill to build suitable cage dimension<br>2. Evaluating suitable cage design to make it more mobile |

**ACHIEVMENT OUTCOME 3:**

| Key knowledge | Key skills |
|---|---|
| 1. Biological needs of tiger<br>2. Conservation of endangered animal. | |

| Overall Learning Sequence | | | |
|---|---|---|---|
| **Week 1** | **Week 2** | **Week 3** | **Week 4** |
| 1. Watch human-tiger conflict video as induction set.<br>2. Students will research how many tigers are left in South East Asia.<br>3. Realization of difficulties to monitor the tiger. | 1. Visit to the zoo if possible.<br>2. Understand basic physical characteristics of a tiger<br>3. Use basic physical information to design the cage next two weeks. | 1. Developing cage design.<br>2. How to monitor initial statistics of the captured tiger (weight, height, blood pressure) without compromising the operator's safety. | 1. Developing automated tiger tagging system<br>2. Incorporate empathy and biomechanical engineering to plant the tag / chip. |
| **Week 5** | **Week 6** | | |
| 1. Monitor tiger roaming path to predict suitable place to set up cage.<br>2. Predicting future cage location. | 1. Presentation and evaluation<br>2. Feedback by teacher and / or expert. | | |

| Lesson Sequence | | | |
|---|---|---|---|
| **W E E K** | **Teaching and Learning Activities** | **Learning Strategies, Teaching Considerations** | **Resources** |
| 1 | 1. Students will be grouped in pairs to research human-tiger conflict in South East Asia using the internet and share their findings with the class.<br>2. The sharing will include:<br>- Examples of other endangered animals. | 1. Reading books or the internet.<br>2. Invite speakers from World Wildlife Fund Malaysia Chapter or Malaysian Nature Society.<br><br>Assessment (formative): Rate students' sharing on questions that have been answered, | 1. https://www.worldwildlife.org/species/directory<br>2. https://www.nytimes.com/2016/04/12/world/asia/wild-tiger-numbers-are-rising-wildlife-groups-say.html<br>3. https://www.youtube.com/watch?v=dbw5TkSFENs |

| | | | |
|---|---|---|---|
| | -different species of tigers<br>-current estimates of wild tigers left in the world / Asia.<br>-Describe how current estimates are collected. | -Examples of other endangered animals.<br><br>-different species of tiger<br>-current estimate of tiger left in the world / Asia.<br>-Describe how current estimate are collected.<br>- Proper use of data representation to represent dwindling number of tigers. | Example of questions asked:<br>1. What is an average height and weight of a tiger?<br>2. By looking at the mouth of a tiger, predict what is its diet?<br>3. Where is tiger's natural habitat?<br>4. How do you differentiate one tiger to another?<br>5. Record a 1-minute video that shows tiger on move.<br>6. Provide a sketch of tiger paw print. |
| 2 | Before we start building the cage, students must understand physical characteristics of a tiger<br><br>1. Generic height & weight of a tiger<br>2. What is their diet?<br>3. Where do they live?<br>4. How to differentiate individual tigers?<br><br>These points will dictate how the students design the cage, how to lure the tiger, expected height and weight of a tiger and the function of stripes as 'fingerprint' of a tiger. | 1. Prepare a list of question for students to ask the zoo experts or aspects they must find out during the visit<br>2. Visit to the zoo if possible<br>3. Have short session with zoo experts / tiger curator.<br><br>Assessment (formative): Evaluate students understanding of physical characteristics of a tiger using the list of question prepared. | 1. https://www.tigers.org.za/tiger-habitats.html<br>2. https://www.youtube.com/watch?v=iSQBTbDrSs8 |

| 3 | 1. Developing outer / physical cage design.<br>2. Understand which material is suitable to be used to make the cage? Considerations: strength, lightweight (easy to move around) or even better collapsible and can be transported to other places easily.<br>3. Include empathy towards tiger:<br><br>Considerations: camouflage, understand appropriate bait to lure the tiger, the size of the cage, how long should we keep the tiger for tagging purposes?<br><br>4. Sketch the prototype.<br>• Developing inner cage system<br>• How to obtain tiger vital stats (height, weight and blood pressure) without human intervention? | 1. Comparing readily available material at hardware store / home center.<br>2. Collect tiger dimension and figure out minimum cage size using geometry.<br>3. Ask students: how to make the cage more approachable to the tigers?<br>4. Internet<br>5. Build an empty spreadsheet and explain how to use it.<br><br>Assessment (summative) on week 6. | 1. https://www.youtube.com/watch?v=rxRoPTp5UHo<br>2. https://www.youtube.com/watch?v=Ldz2eB2zSvY<br>3. https://wildlifeact.com/blog/gps-and-vhf-tracking-collars-used-for-wildlife-monitoring/<br><br><br>Design Learning Process for Students |
|---|---|---|

| 4 | 1. Understanding tiger anatomy and suggesting new way to equip the GPS-enabled collar onto the animal.<br>2. Traditional tiger collar system requires direct human contact, thus we need a way to put on the collar or equip it at other places besides on the neck of tiger. | 1. Students should already made observation at the zoo how a tiger move (locomotion, gait) and their behaviour.<br>2. Students should consider<br>- The GPS collar should be equipped fast<br>- the collar should not restrict the animal movement<br>- the collar should not be easily shaken off (fell off easily).<br><br>3. Does the collar is a good idea? Or do we need an innovative way to have GPS tracker inside the tiger?<br>- GPS Harness?<br>- Maybe plant it under the tiger's skin?<br><br>Assessment (summative) on week 6. A tiger model will be available in week 6 so the students can build a mock up / prototype of their new GPS collar and attach it to the model. | 
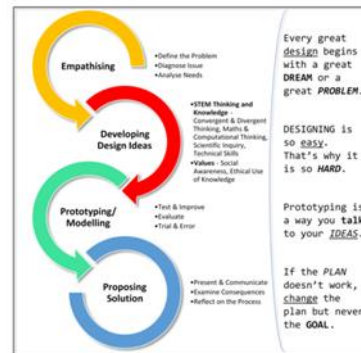
Design Learning Process for Students |

| | | | |
|---|---|---|---|
| **5** | 1. Where to set up the cage since we do not have initial GPS data? Since we don't have access to real tiger or GPS data, we can simulate the tiger roaming behaviour to local cats.<br>2. Observations made for one week. | 1. Students should already have observed a tiger paw print at the zoo.<br>2. Students also should realise from week 1 that the tiger is a solitary animal, except a cub needs to be with its mother.<br>3. Propose a spreadsheet to record the movement of cats.<br><br>Assessment (summative) on week 6. | Suggested spreadsheet<br><br><table><tr><td>Cat</td><td>Coat Pattern Colour</td><td>Time Observed</td><td>Location</td></tr><tr><td>1</td><td></td><td></td><td></td></tr><tr><td>2</td><td></td><td></td><td></td></tr><tr><td>3</td><td></td><td></td><td></td></tr></table> |
| **6** | 1. Assessment of cage idea<br><br>2. The students will present their idea<br><br>3. The best idea will be evaluated by an expert. | Assessment (summative): assess the cage idea using rubric as presented in resources column<br><br>Presentation skill: the students will be evaluated by their preparedness and their knowledge about what they are presenting. | Suggested rubric (tick suitable box)<br><br>Group: _____<br><br><table><tr><td>Weightage</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr><tr><td>Cage Design</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Tiger data spreadsheet</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>New GPS Collar Idea</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Completing Cat Observation Simulation</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Presentation Skill</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Overall</td><td></td><td></td><td></td><td></td><td></td></tr></table> |

# Curriculum alignment with CCRLS + Other countries teaching standards.

## Science:

| Topics | Reference |
|---|---|
| Topic: Living Things and Non-Living Things<br>Sub-topic: Characteristics of Living Things and Non-Living Things<br>Key Stage 1: Identify the basic needs of living things – air, water, food | Page 98 |
| Topic: Animals<br>Sub-topic: Body Parts of Animals<br>**Key Stage 1**<br>• Identify the main parts of the body of animals • Compare the body parts of different animals • Generalise that some animals have the same characteristics while others have different characteristics as to body parts<br>• Classify similarities and differences within groups of animals as to body parts<br>**Key Stage 2**<br>• Explain that the characteristics of body parts of animals are used as bases in classification<br>• Explain that the characteristics of body parts of animals are suited to where they live | Page 107 |
| Topic: Animals<br>Sub-topic: Basic Needs of Animals<br>**Key Stage 1**<br>• State the basic needs of animals<br>• Describe the food sources for animals<br>• Identify shelter for animals | Page 107 |
| Topic: Animals<br>Sub-topic: Animal Movements<br>**Key Stage 1**<br>• Describe the different kinds of animal movements<br>• Understand the importance of animal movements | Page 108 |
| Topic: Animals<br>Sub-topic: Endangered Animals and Conservation<br>**Key Stage 2**<br>• Identify endangered animals by giving examples<br>• Explain why animals become endangered in their natural habitat<br>• Give examples of extinct animals<br>• Explain why certain animals are facing the threat of extinction | Page 110 |

## Technology and Engineering:

| Topics | Reference |
|---|---|
| Learn how to use Microsoft PowerPoint | "World of Science and Technology" Malaysian Science and Technology curriculum standard for Year 2 pp 33 - 49 |
| Solving problems and make decisions using Microsoft Excel | "World of Science and Technology" Malaysian Science and Technology curriculum standard for Year 3 p 47 |
| Stability and strength of a structure (cage design) | "Science" Malaysian Science curriculum standard for Year 4 p 79 (Chapter: Technology) |

## Mathematics:

| Topics | Reference |
|---|---|
| **Key stage 1:**<br>Strand: Shapes figures and solids<br>1. Exploring Shapes of Objects □ Cage shape and dimension | Page 25 |
| **Key stage 1:**<br>Strand: Pattern and Data Representations<br>1. Collecting data and representing structure | Page 27 |
| **Key stage 2:**<br>Strand: Shapes figures and solids<br>1. Extending Measurement of Volume in Relation to Surface | Page 41 |
| **Key stage 2:**<br>Strand: Data Handling and Graphs<br>1. Arranging Tables for Data Representations<br>2. Drawing and Reading Graphs for Analysing Data | Pp 47-48 |