



# 21世紀教室

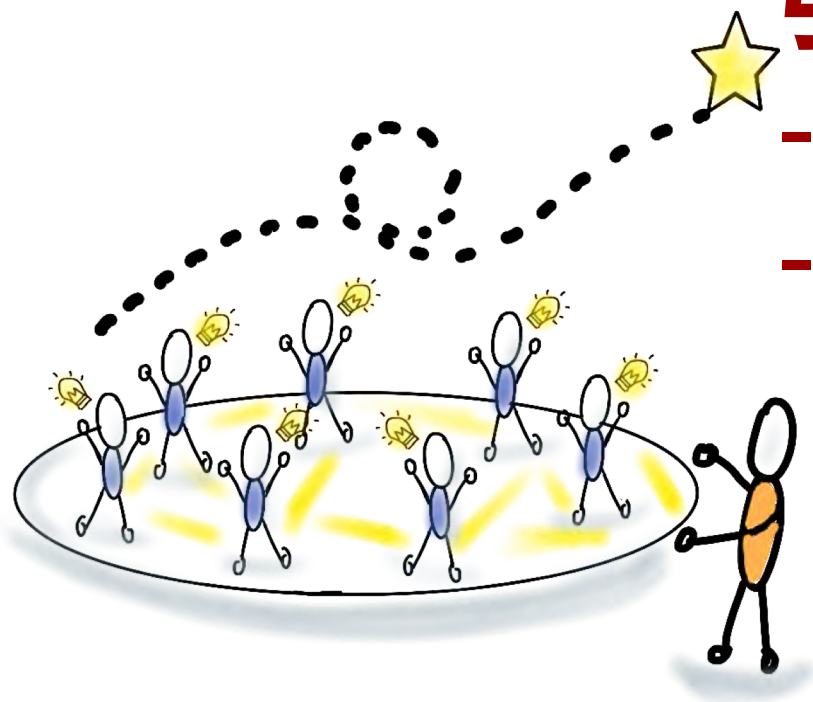
## 視覺筆記在教學中的 應用

## Visual Sketchnotes in Learning & Teaching

德蘭中學

科學科主任及STEM 聯絡員  
香港翻轉教育協會科學科召集人  
蕭煒炘老師

# 在教學上，什麼是**視覺引導**？



**引導者(Facilitator)**

-不再是單向教授知識

-提升教室的互動

-老師與學生間

-學生與學生間

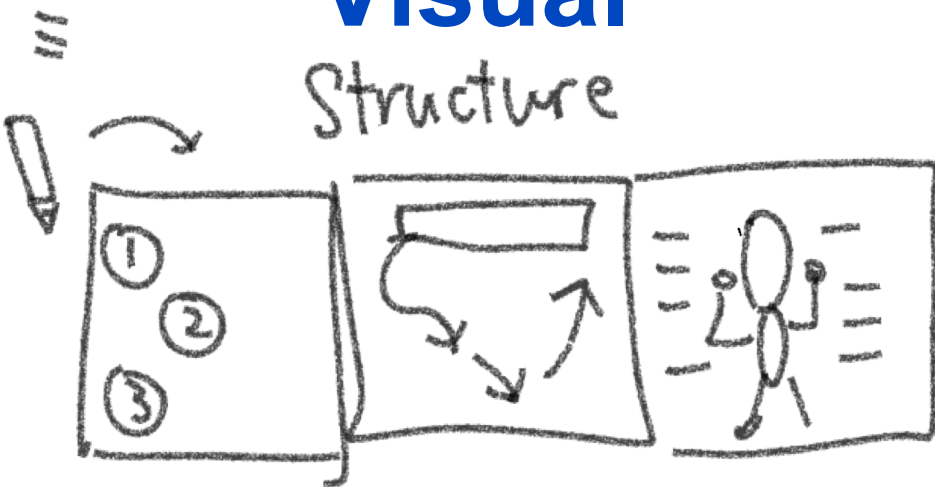
以**視覺化**的方式**引導**學生思考

**提升教室的互動**

# 在教學上，如何運用是**視覺引導**？

**視覺**  
**Visual**

Structure



**引導**

**Facilitation**



以**視覺化**的方式去**引導**學生

**更清楚了解知識內容**

# PHOTOSYNTHESIS is...??

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**Photosynthesis** is a process used by plants and other organisms to **convert light energy** into **chemical energy** that can later be **released** to fuel the organisms' activities. This chemical energy is stored in **carbohydrate** molecules, such as **sugars**, which are synthesized from **carbon dioxide** and **water** – hence the name *photosynthesis*, from the Greek **φῶς**, *phōs*, "light", and **σύνθεσις**, *synthesis*, "putting together".<sup>[1][2][3]</sup> In most cases, **oxygen** is also released as a waste product. Most **plants**, most **algae**, and **cyanobacteria** perform photosynthesis; such organisms are called **photoautotrophs**. Photosynthesis is largely responsible for producing and maintaining the **oxygen content** of the Earth's atmosphere, and supplies all of the organic compounds and most of the energy necessary for **life on Earth**.<sup>[4]</sup>

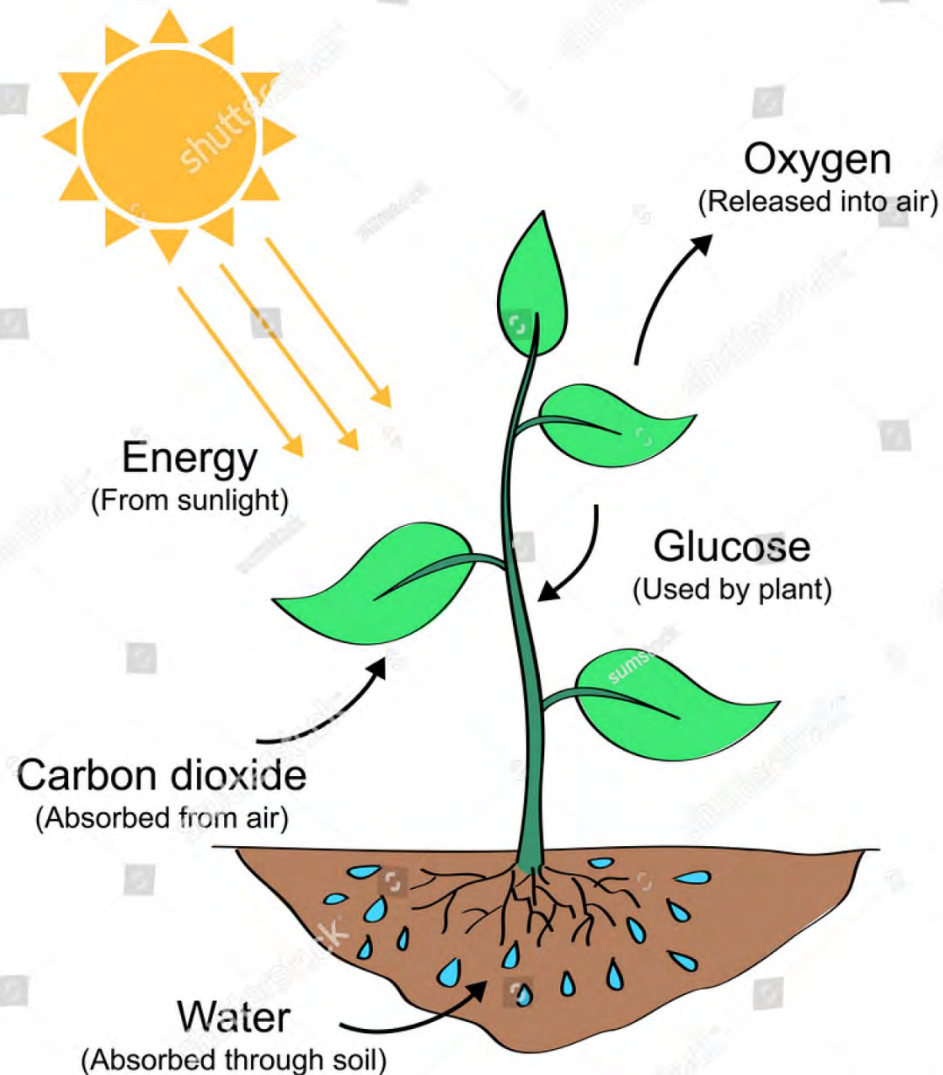
Although photosynthesis is performed differently by different species, the process always begins when energy from light is absorbed by **proteins** called **reaction centres** that contain green **chlorophyll** pigments. In plants, these proteins are held inside **organelles** called **chloroplasts**, which are most abundant in leaf cells, while in bacteria they are embedded in the **plasma membrane**. In these light-dependent reactions, some energy is used to strip **electrons** from suitable substances, such as water, producing oxygen gas. The hydrogen freed by the splitting of water is used in the creation of two further compounds that serve as short-term stores of energy, enabling its transfer to drive other reactions: these compounds are reduced **nicotinamide adenine dinucleotide phosphate** (NADPH) and **adenosine triphosphate** (ATP), the "energy currency" of cells.

In plants, algae and cyanobacteria, long-term energy storage in the form of sugars is produced by a subsequent sequence of light-independent reactions called the **Calvin cycle**; some bacteria use different mechanisms, such as the **reverse Krebs cycle**, to achieve the same end. In the Calvin cycle, atmospheric carbon dioxide is **incorporated** into already existing organic carbon compounds, such as **ribulose biphosphate** (RuBP).<sup>[5]</sup> Using the ATP and NADPH produced by the light-dependent reactions, the

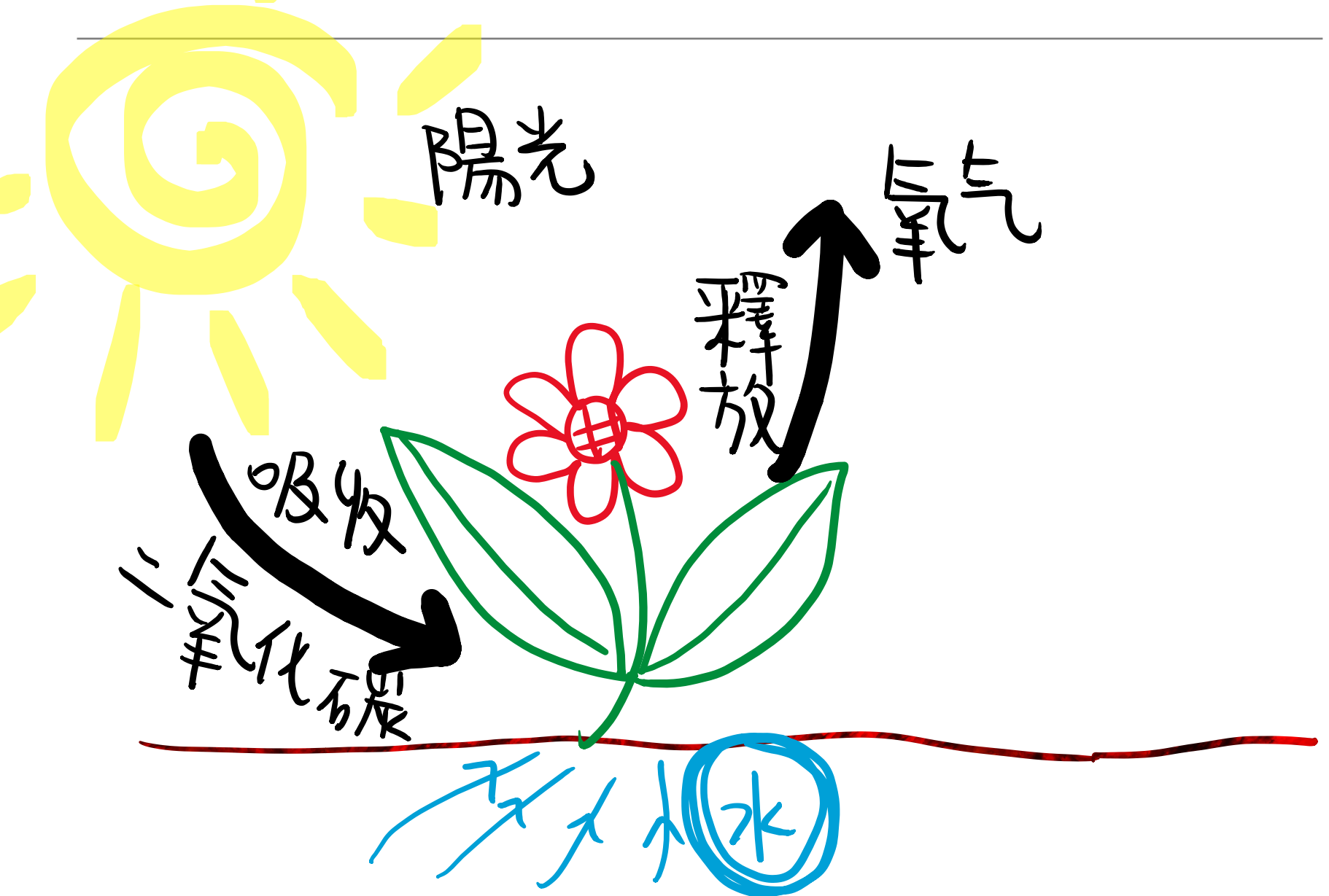


# PHOTOSYNTHESIS is...??

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# PHOTOSYNTHESIS is...??



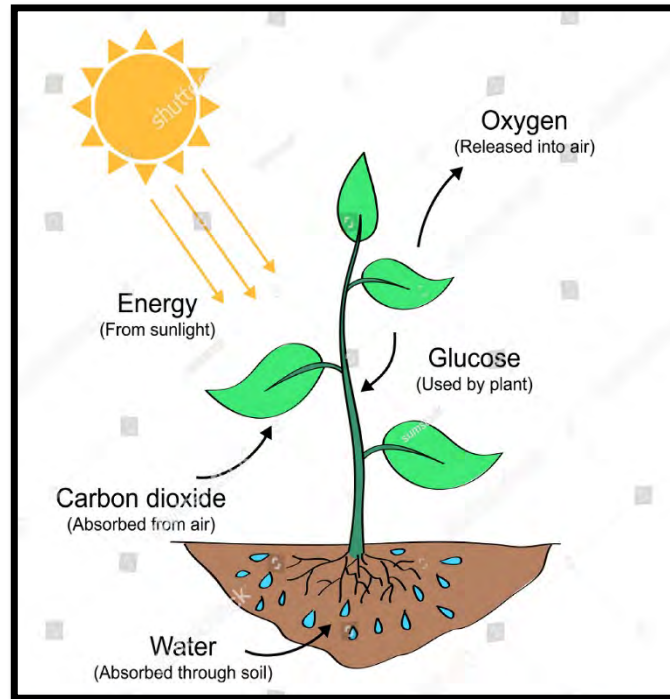


# 知識吸收?

## 文字?

- **Photosynthesis** is a process used by plants and other organisms to convert light energy into chemical energy that can later be released to fuel the organisms' activities. This chemical energy is stored in carbohydrate molecules, such as sugars, which are synthesized from carbon dioxide and water – hence the name photosynthesis, from the Greek φῶς, phōs, "light", and σύνθεσις, synthesis, "putting together". In most cases, oxygen is also released as a waste product. Most plants, most algae, and cyanobacteria perform photosynthesis; such organisms are called photoautotrophs. Photosynthesis is largely responsible for producing and maintaining the oxygen content of the Earth's atmosphere, and supplies all of the energy necessary for life on Earth.<sup>[4]</sup>
- Although photosynthesis is performed differently by different species, the process always begins when energy from light is absorbed by proteins called reaction centres that contain green chlorophyll pigments. In plants, these proteins are held inside organelles called chloroplasts, which are most abundant in leaf cells, while in bacteria they are embedded in the plasma membrane. In these light-dependent reactions, some energy is used to strip electrons from suitable substances, such as water, producing oxygen gas. The hydrogen freed by the splitting of water is used in the creation of two further compounds that serve as short-term stores of energy, enabling its transfer to drive other reactions: these compounds are reduced nicotinamide adenine dinucleotide phosphate (NADPH) and adenosine triphosphate (ATP), the "energy currency" of cells.

## 圖像?

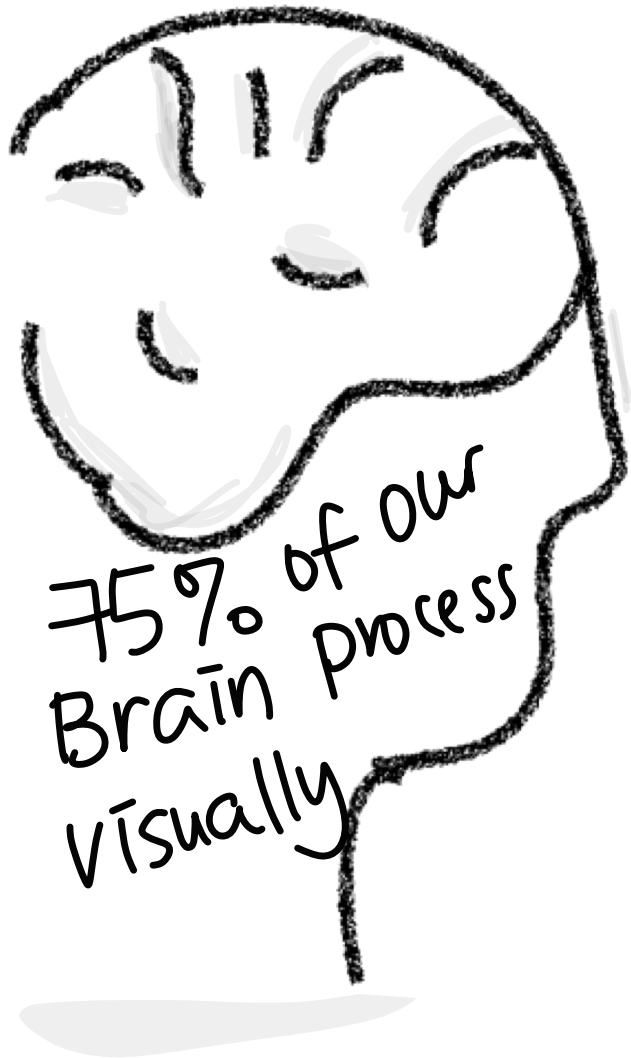


## 圖像引導?



# 為什麼是要用**視覺筆記**？

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**1. 腦袋的75%  
是用來處理視覺圖像**



# 為什麼是要用**視覺筆記**？

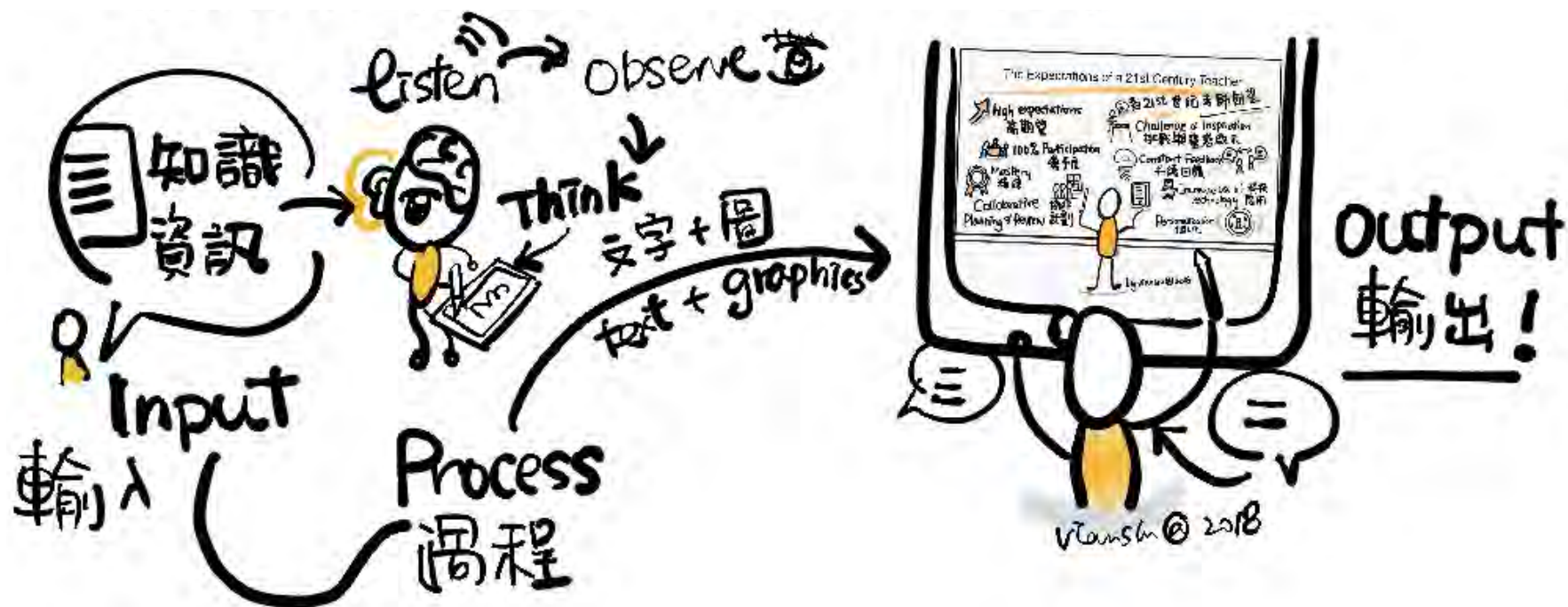


## 2. 左右腦並用 有效啟動 全腦思維



# 為什麼是要用**視覺筆記**？

## 3. 提升記憶與理解



知識澄清, 強化重點

# 老師在教學過程中如何運用 視覺引導

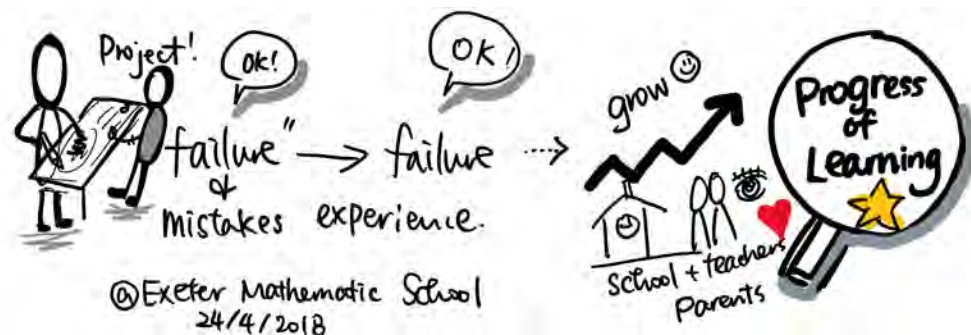
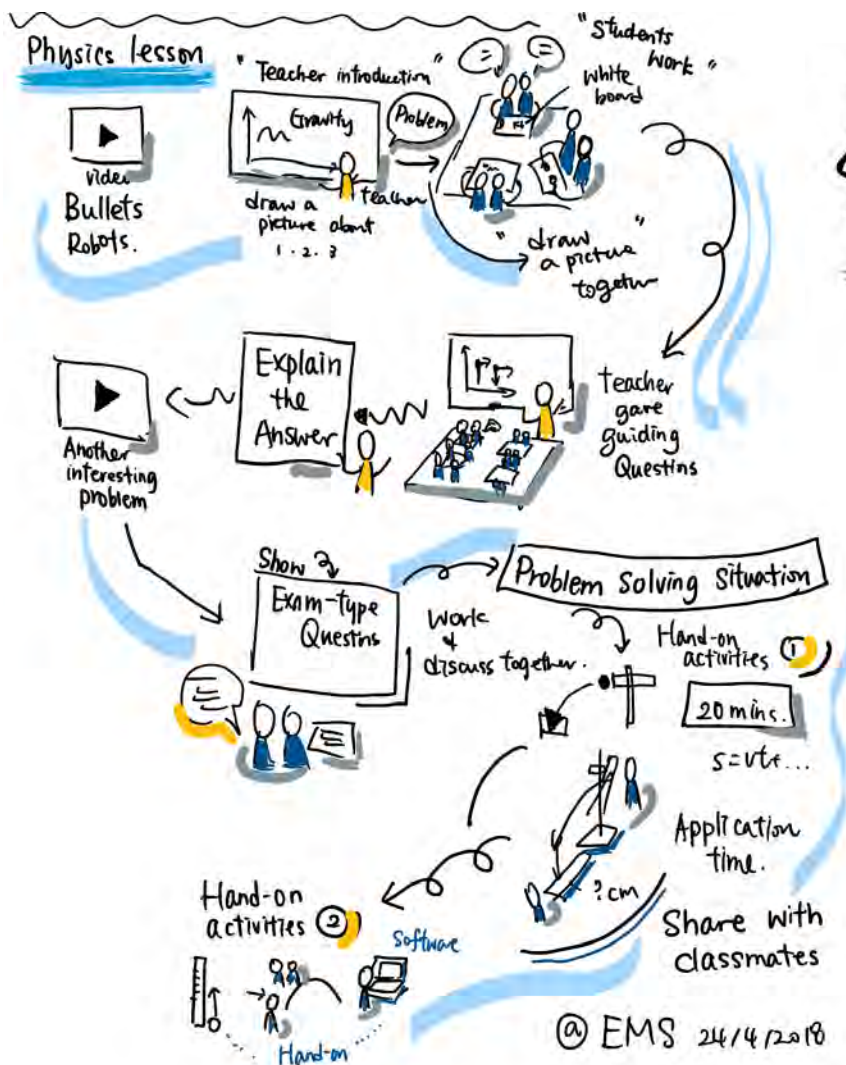




# 學生在學習過程中如何運用 視覺筆記



# 我的視覺“觀課記錄”-在英國中學的一個課堂





# 視覺筆記第一法則-不是藝術品!

## Visual Sketchnotes

Rule 1: It is  
not ART !!

⇒ #Everyone  
Can  
create !!

~~I cannot  
Draw !!~~





# Basic Visual Elements

1 DRAW TIME

Bullets

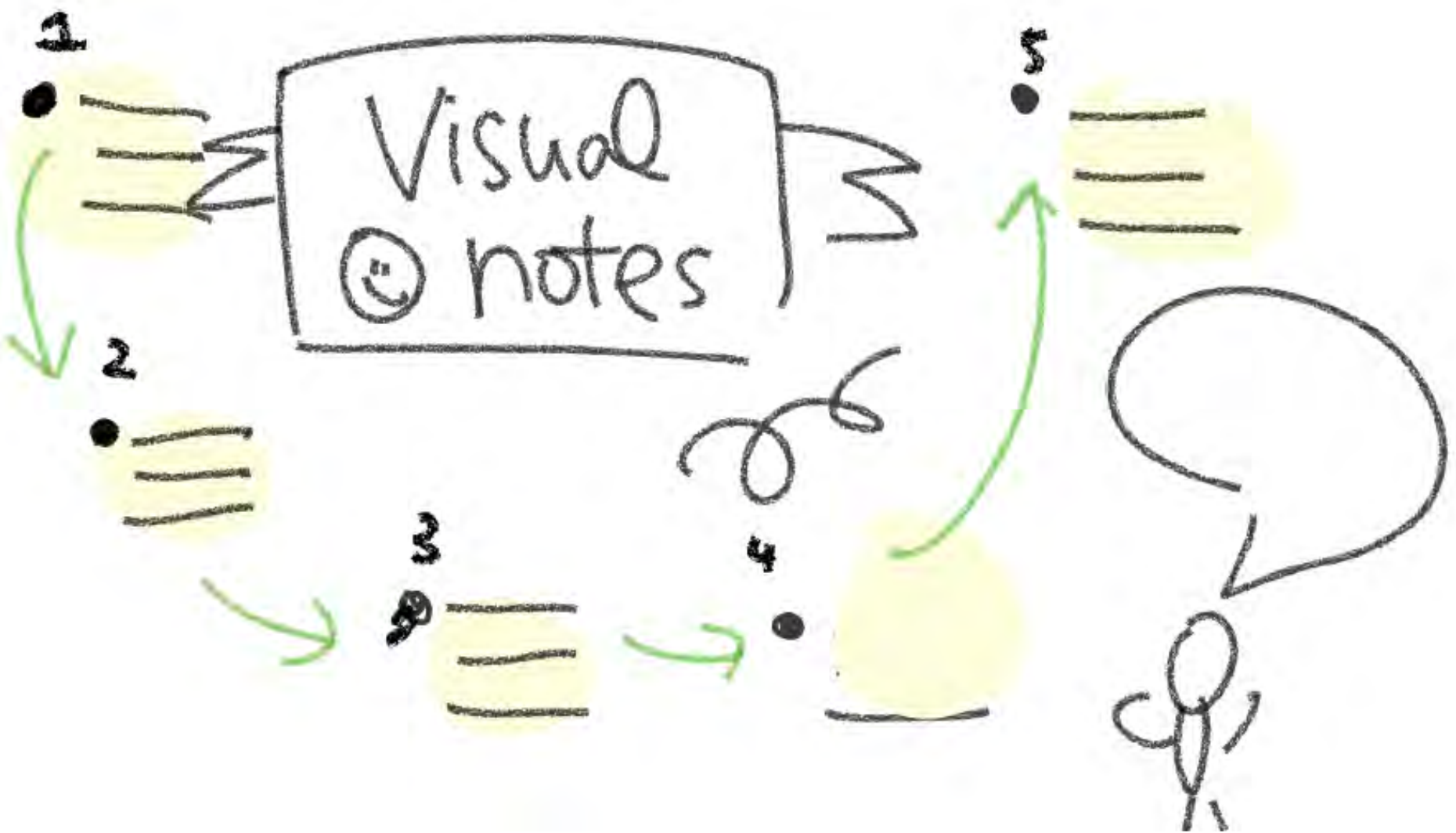


Containers



Line & arrows





# 視覺筆記第二法則-敢於動筆

Visual Sketchnotes

Rule 2:



DARE to DRAW



#Everyone

Can  
create !!

~~I cannot  
Draw !!~~



TIME



WRITE



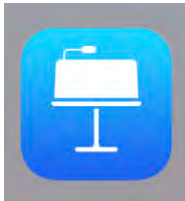
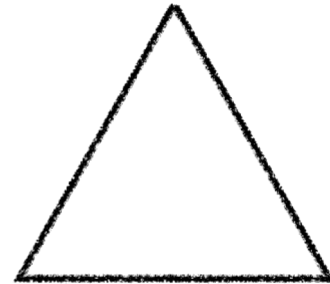
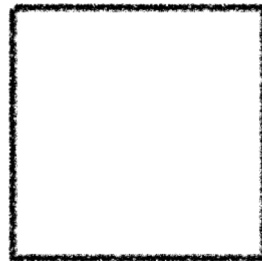
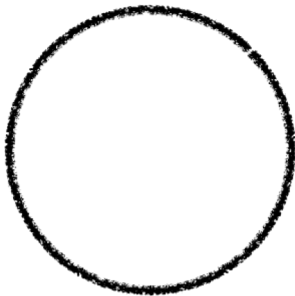
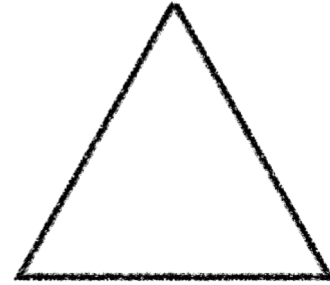
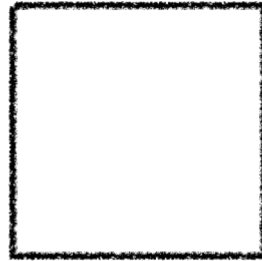
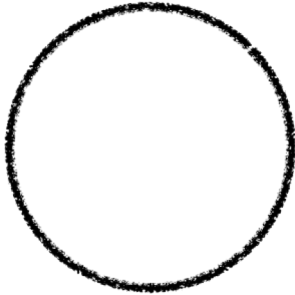
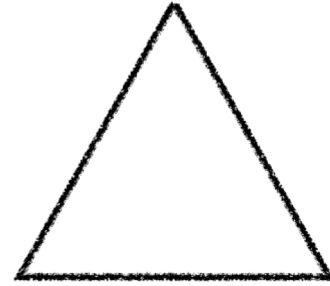
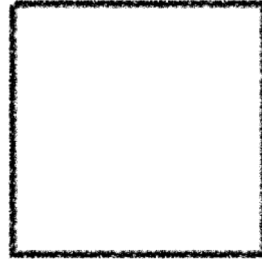
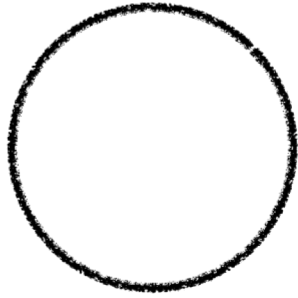
Reading



idea

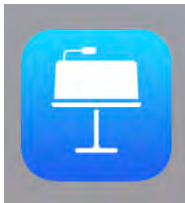
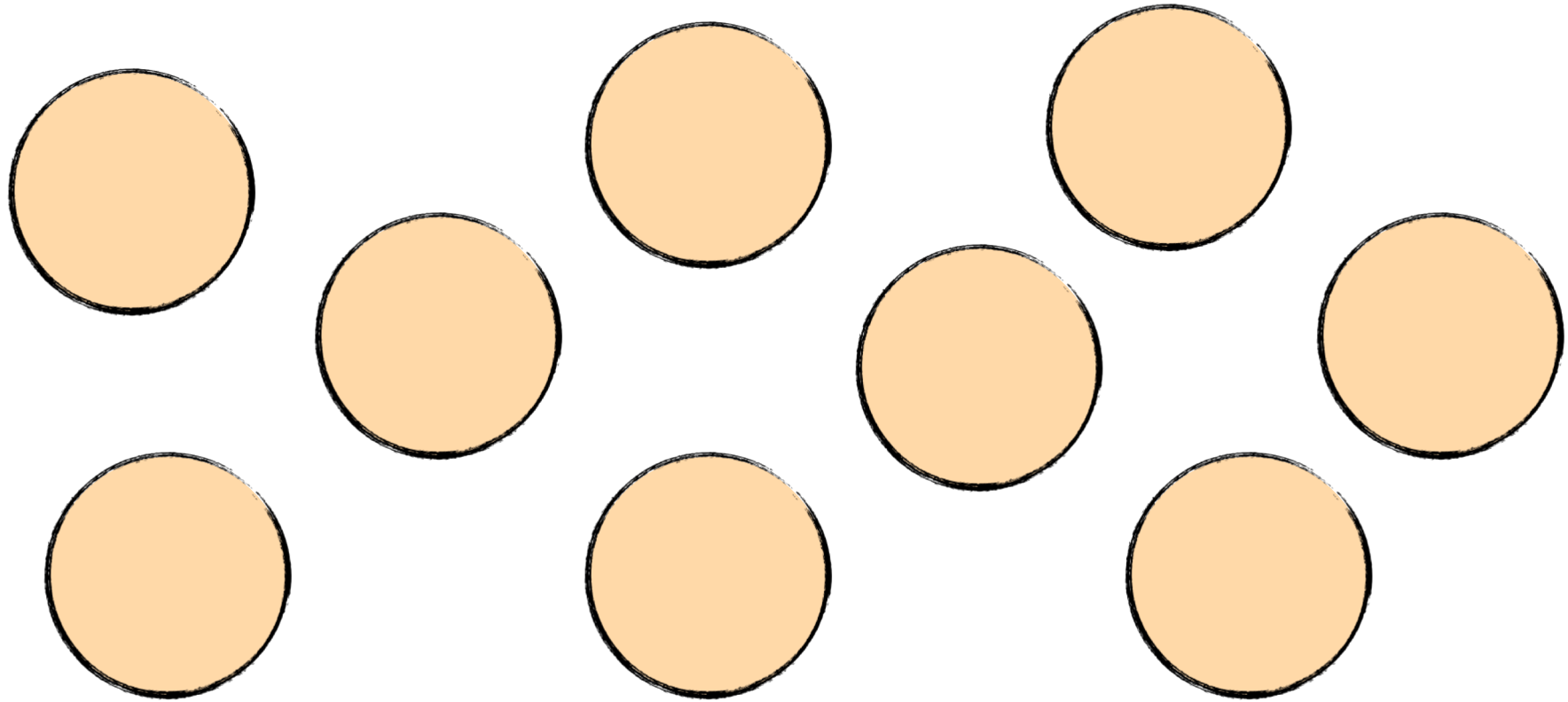
# Begin with Basic Shapes 😊

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# facial Expressions

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# APPS with drawing

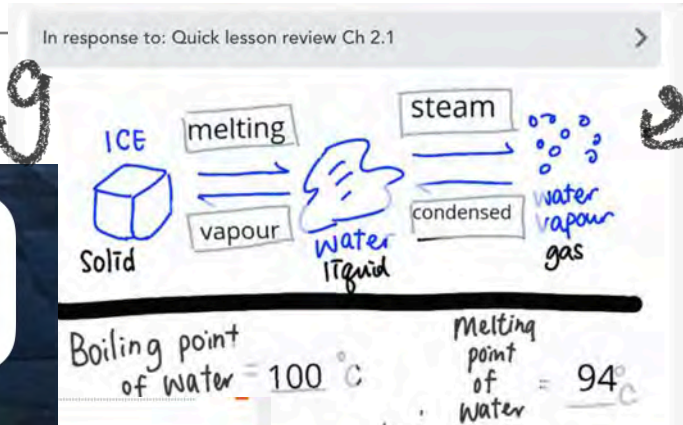


## Nearpod

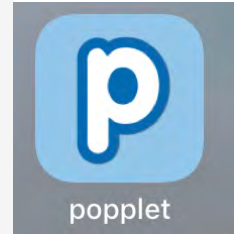
draw  
it!



CLASS  
Seesaw

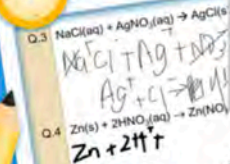
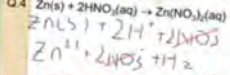
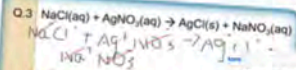
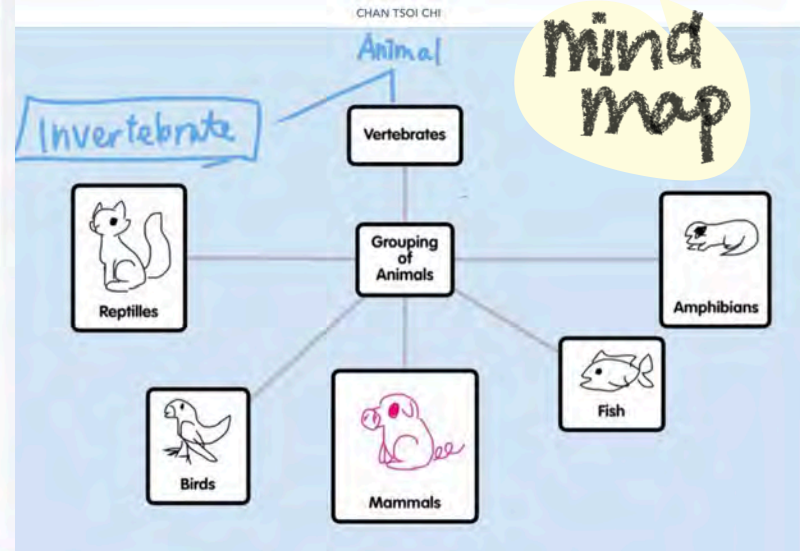


# visual e- notebook

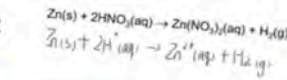
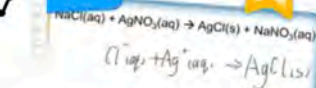
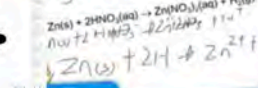
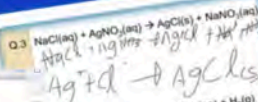


popplet

# mind map

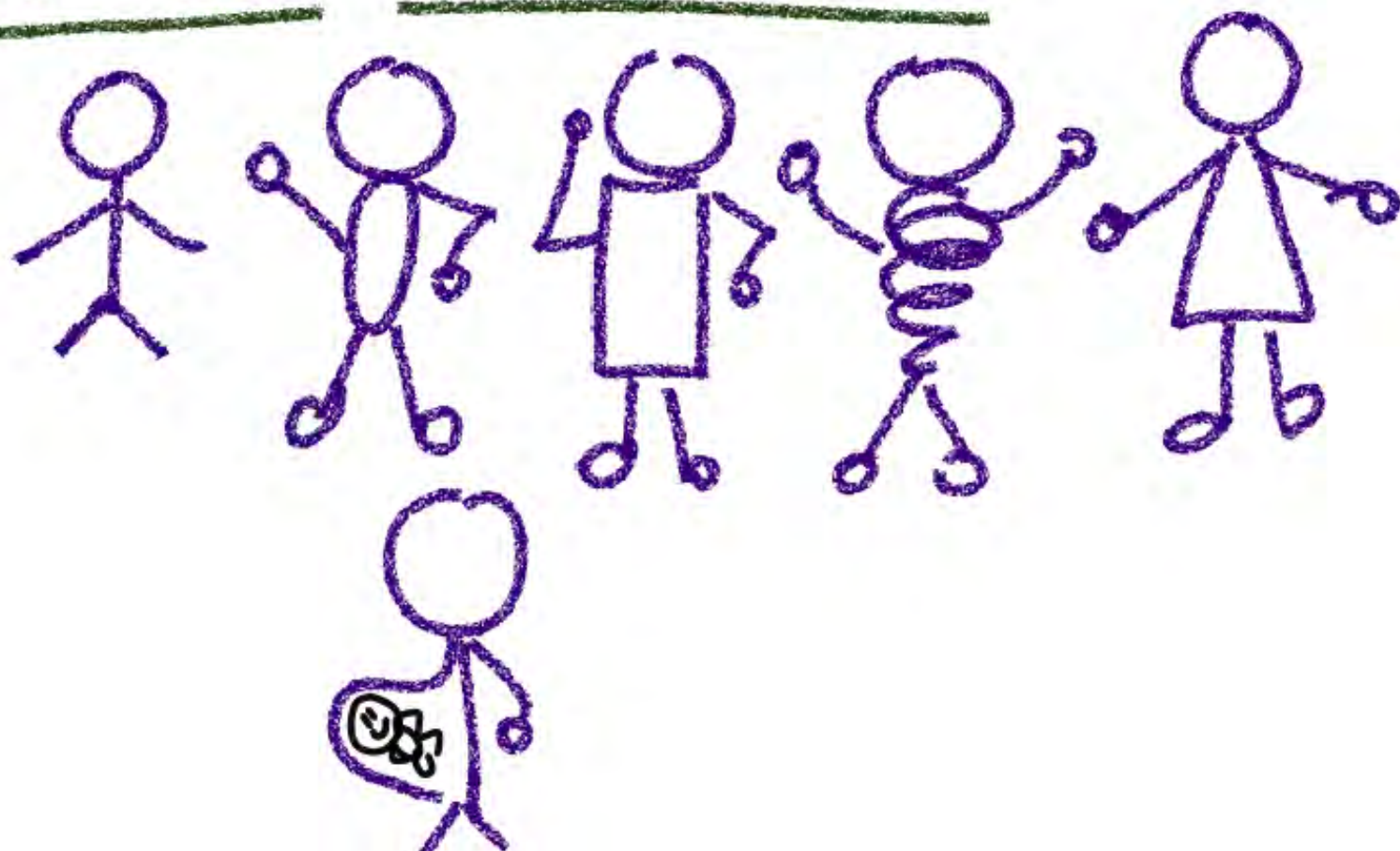


## Post Session Report

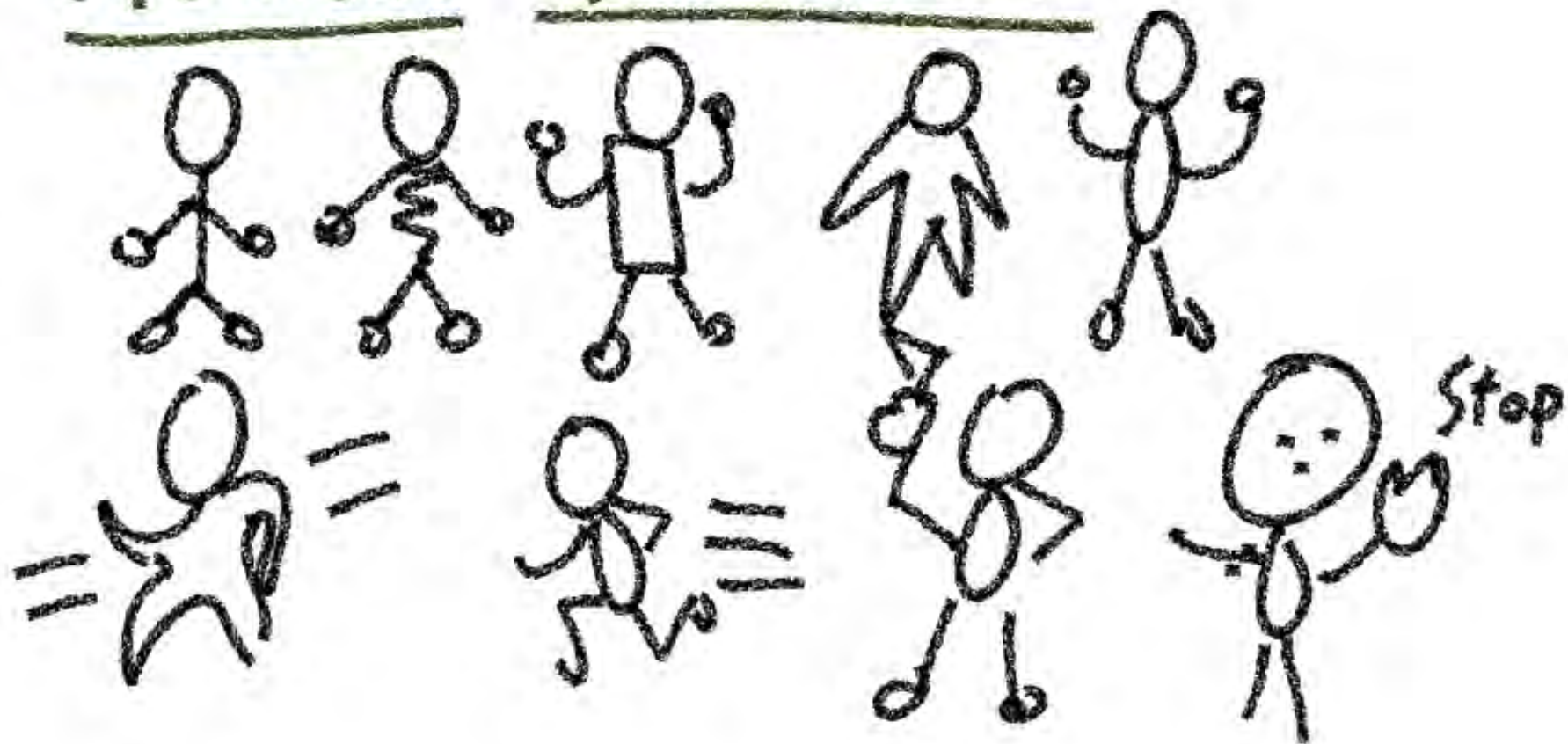




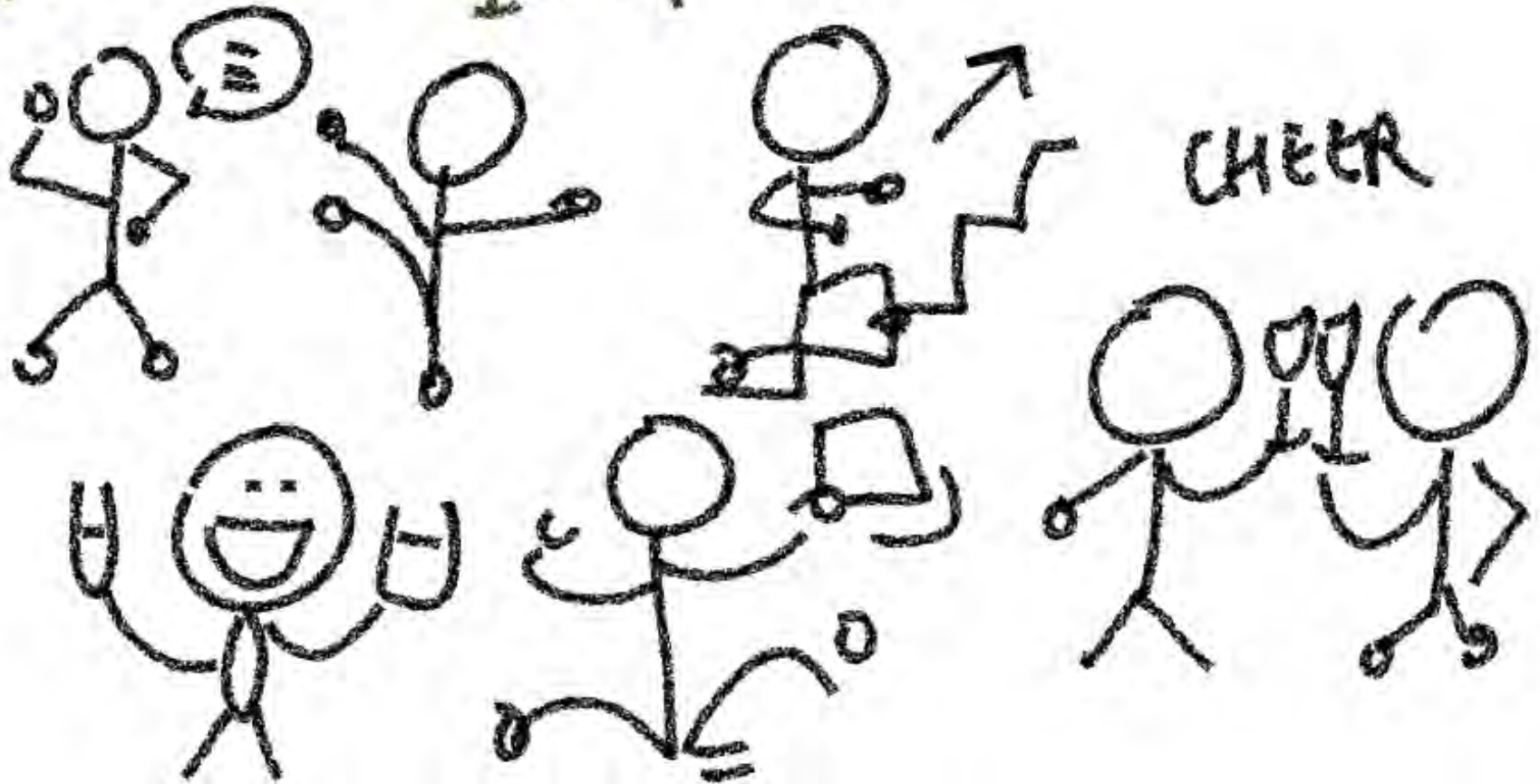
# Human · 不同的人



# Human · 不同的人

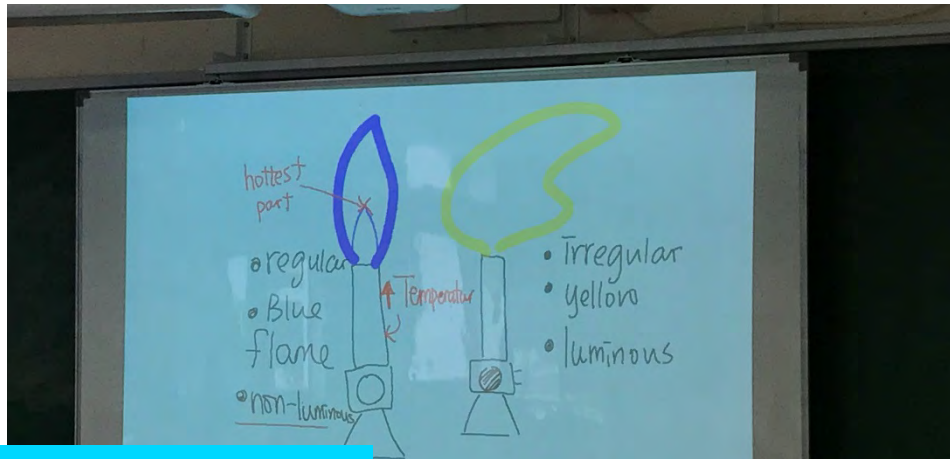


# Actions 動作





# 視覺筆記在教學中的應用-科學科



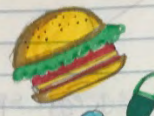
老師


1. 知識點博覽
2. 設計視覺化複習活動










8/2/2018

ch.4 Forms of Energy  
\* get converted → 儲存

5.  Chemical energy 化學能  
由食物轉化成化學能 (動能)

vitame C 

ch.4.1 Forms of Energy

- 1. kinetic energy  
more & more motion  
↑ faster, kinetic energy ↑
- 2. light energy  
 (光能)
- 3. heat energy  
 (熱能)
- 4. Potential energy  
e.g.  high  
 low PE (機械能)  
 spring (彈簧)
- electrical energy  

- 6. sound energy  


1. Energy converter  
2. motor a generator  
3. generating electricity

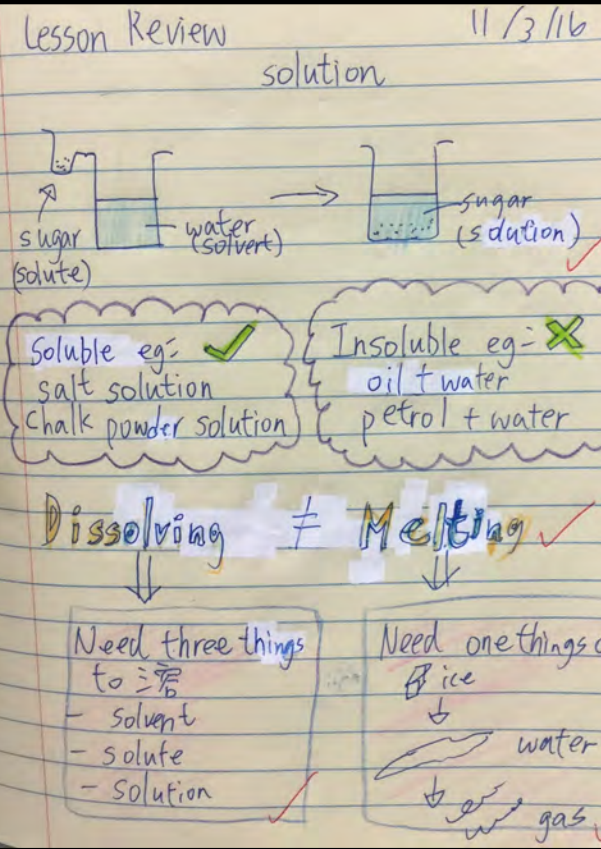
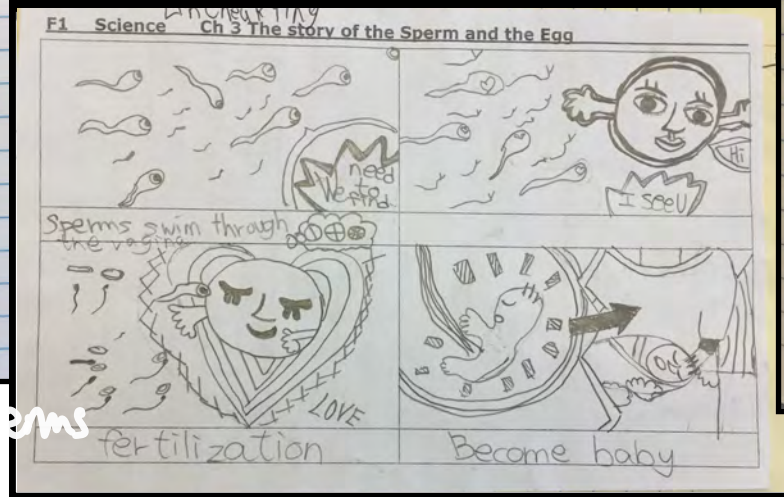
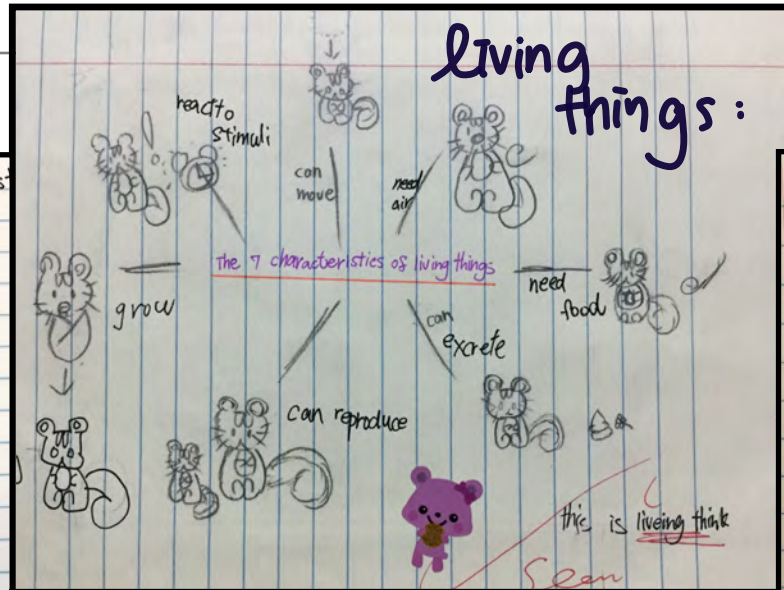
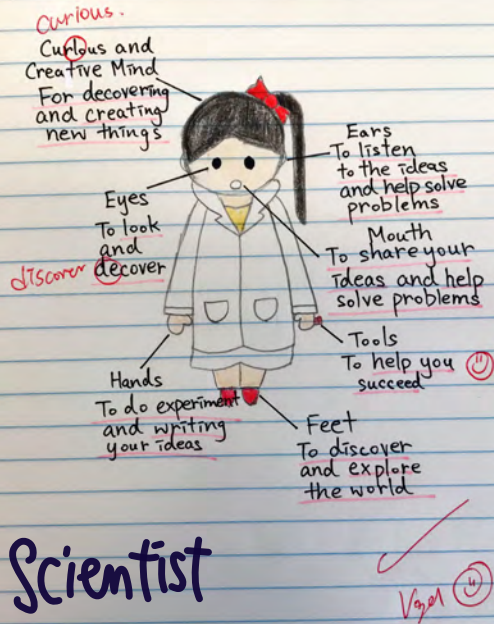
學生

1. 制作視覺化筆記
2. 講解課堂回顧



# 我學生的視覺筆記-科學科

Describes the qualities and work of scientists



# 視覺筆記第三法則-互相觀摩

## Visual Sketchnotes

Rule 3:

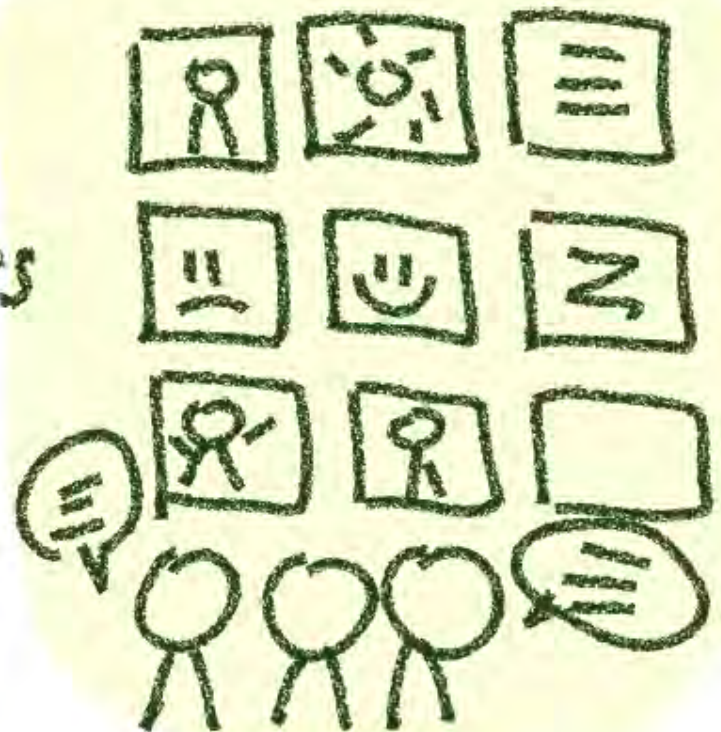
SHARE with others



#Everyone

Can  
create !!

~~I cannot  
Draw!!~~





12:41 AM Wed 9 Jan

34%

20190109 Apple

12:42 AM Wed 9 Jan

34%

Visual

1

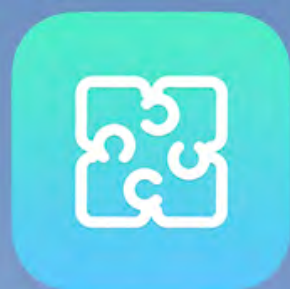
2

3

4

next  
page

Page 1

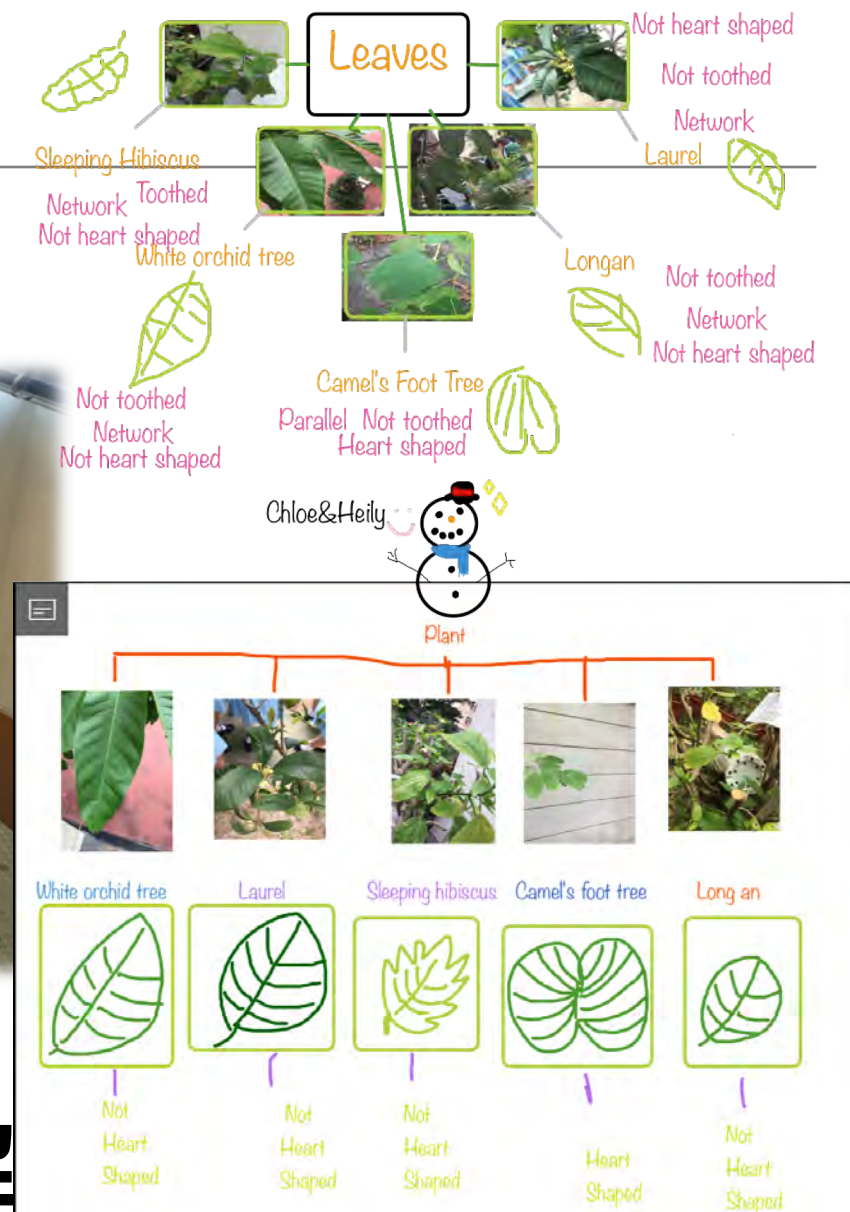


BaiBoard 3

# 學生課堂及功課



提升互動，促進理解



分類圖

There is a **wide variety** of living things on Earth. Can you name some animals? Write down a list of as many animals as you can. Scientists have divided animals into two groups: those with backbones and those without. If you look over your list, probably all of the animals that you have named have bones, with a series of large bones in their backs that help them to move (e.g. run, climb, fly and swim). This is called the backbone or vertebral column. All animals with a backbone are called **vertebrates**. Vertebrates make up most of the "animals" that we are familiar with. Exceptions to this would be things like an insect, an octopus, a lobster or crab, a jellyfish, or a snail. Animals without backbones are called **invertebrates**.



Vertebrates can be classified into five groups, based on their skin covering, characteristics of their limbs (arms and legs, or their equivalent such as wings or fins), how they reproduce and how they maintain body temperature. Knowing the five classes of vertebrates and their characteristics helps you to understand more about these animals.

**Fish** live in water. Their skin is generally covered with slimy scales. Their limbs are modified into fins for swimming. They breathe with gills and lay eggs in water. Their body temperature changes with the environment. **Amphibians** can live in water and on land. They have moist skin and do not have scales, hair, or feathers. The skin can be smooth or rough. They breathe with gills, skin or lung. They lay eggs in water. Their body temperature changes with the environment. **Reptiles** have dry, hard scales. They breathe with lungs. Their body temperature changes with the environment. They lay eggs on land. **Birds** is covered with feathers and have a beak. Their forelimbs are modified as wings. They breathe with lungs. They lay eggs. They can maintain a constant body temperature. **Mammals** have fur or hair on the skin. They have mammary glands to produce milk for the young. They breathe with lungs. They can maintain a constant body temperature.

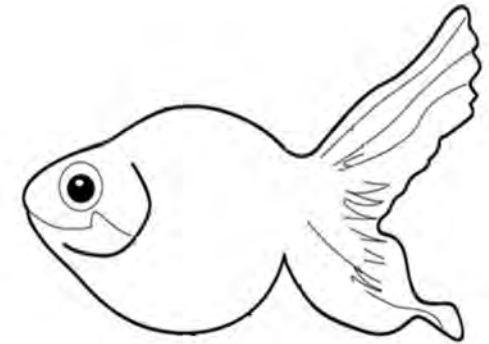
## 1. Fish( example: goldfish)

Skin covering

g

ction

ture



teristics of the vertebrates groups (1)

### 2.Amphibians(example: frog)



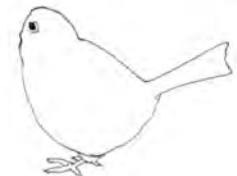
### 3.Reptiles(example: crocodile)



Group Work: Characteristics of the vertebrates groups (2)

### 4.Birds(example: sparrow)

Skin covering  
Limbs  
Breathing  
Reproduction  
Body Temperature



### 5.Mammals (example: chimpanzee)

Skin covering  
Limbs  
Breathing  
Reproduction  
Body Temperature

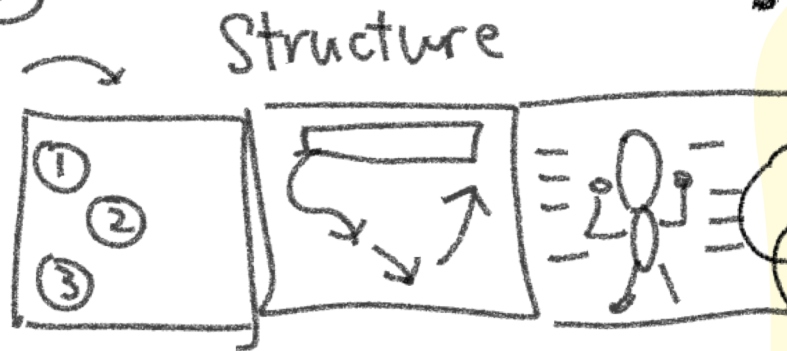




# 如何視覺化內容？

How to Visualize Information  
or idea ??

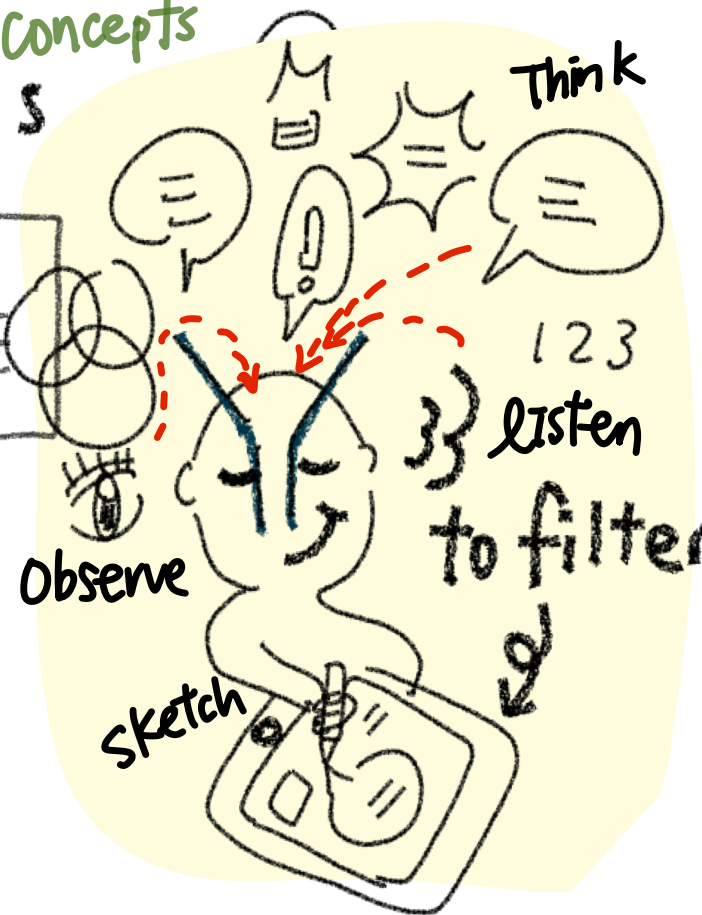
- Listen / Read / Observe → keyword / concepts
- THINK
- Sketch



用心聽/看/閱讀

→ 思考


→ 動手畫

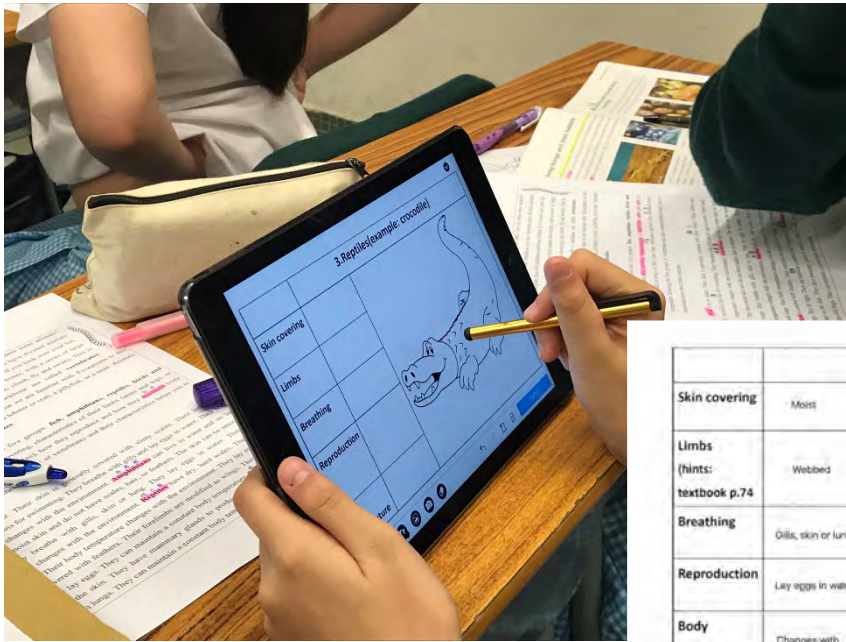




# 了解重點→以視覺方式表達

15+ Fish live in water. Their skin is generally covered with slimy scales. Their limbs are modified into fins for swimming. They breathe with gills and lay eggs in water. Their body temperature changes with the environment. **Amphibians** can live in water and on land. They have n

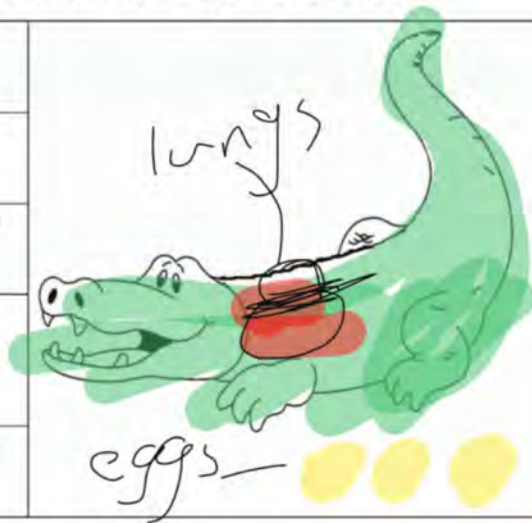
	1. Fish( example: goldfish)	
Skin covering		
Limbs		
Breathing		
Reproduction		
Body Temperature		



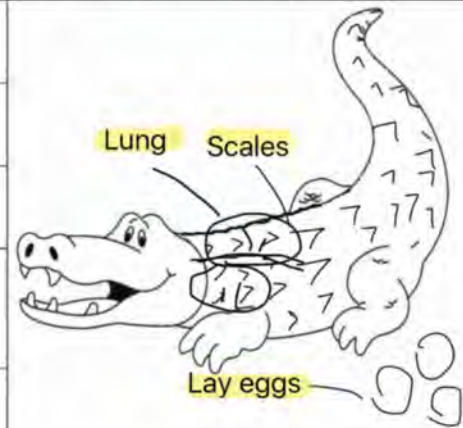
2. Amphibians (example: frog)	
Skin covering	Moist
Limbs (hints: textbook p.74)	Webbed
Breathing	Gills, skin or lungs
Reproduction	Lay eggs in water
Body Temperature	Changes with the environment



3. Reptiles (example: crocodile)	
Skin covering	Dry and hard scales
Limbs	X
Breathing	Breathe with lungs
Reproduction	Lay eggs on land
Body Temperature	Changes with the environment



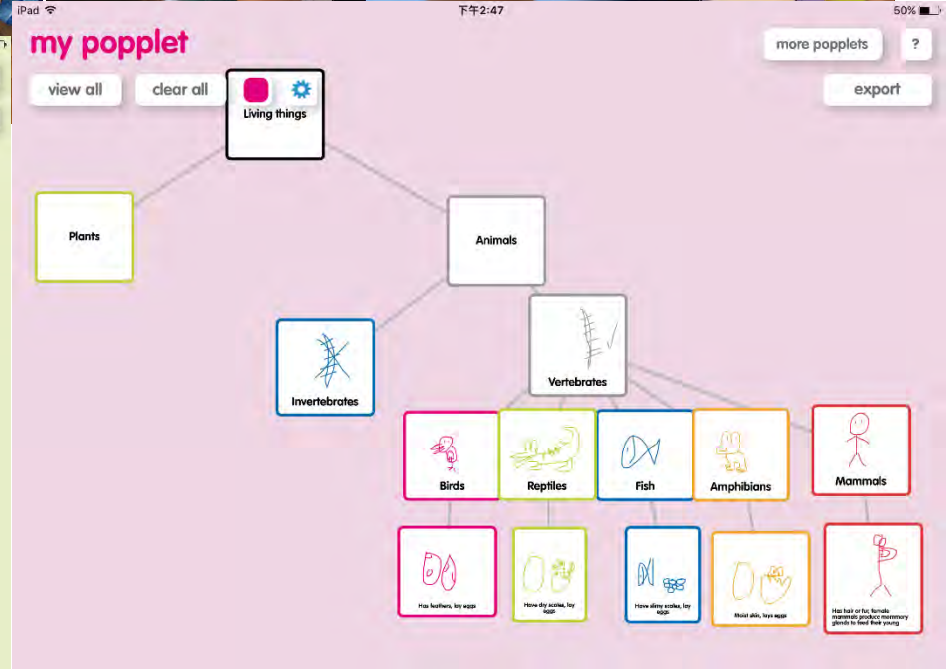
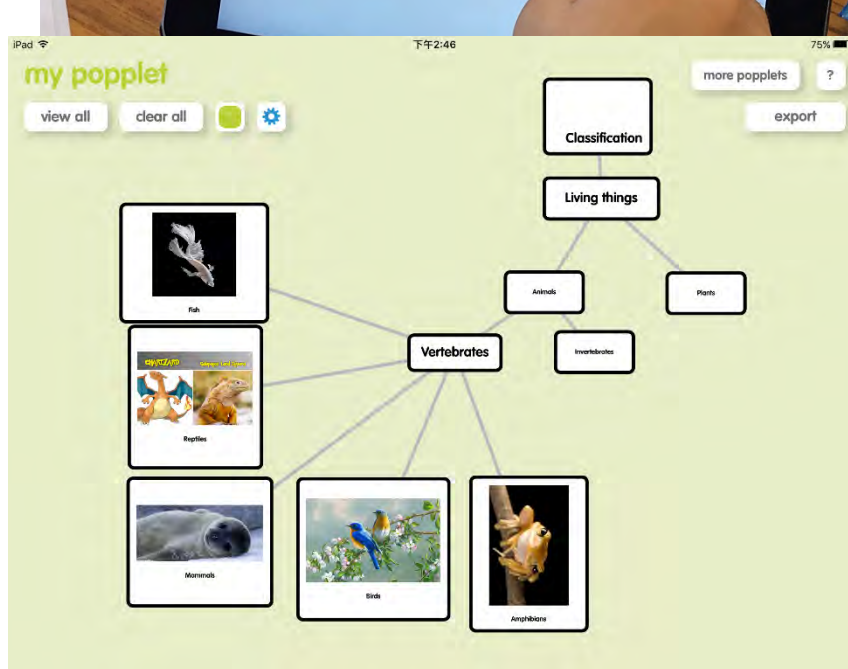
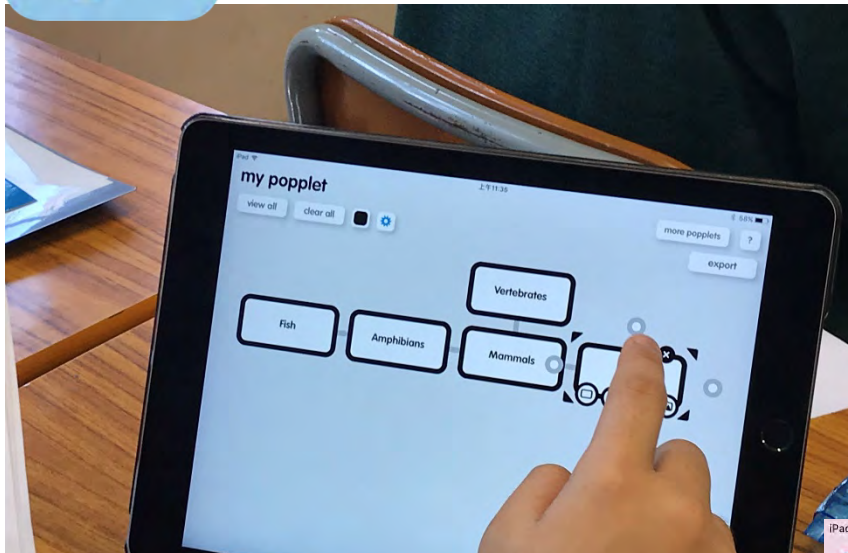
3. Reptiles (example: crocodile)	





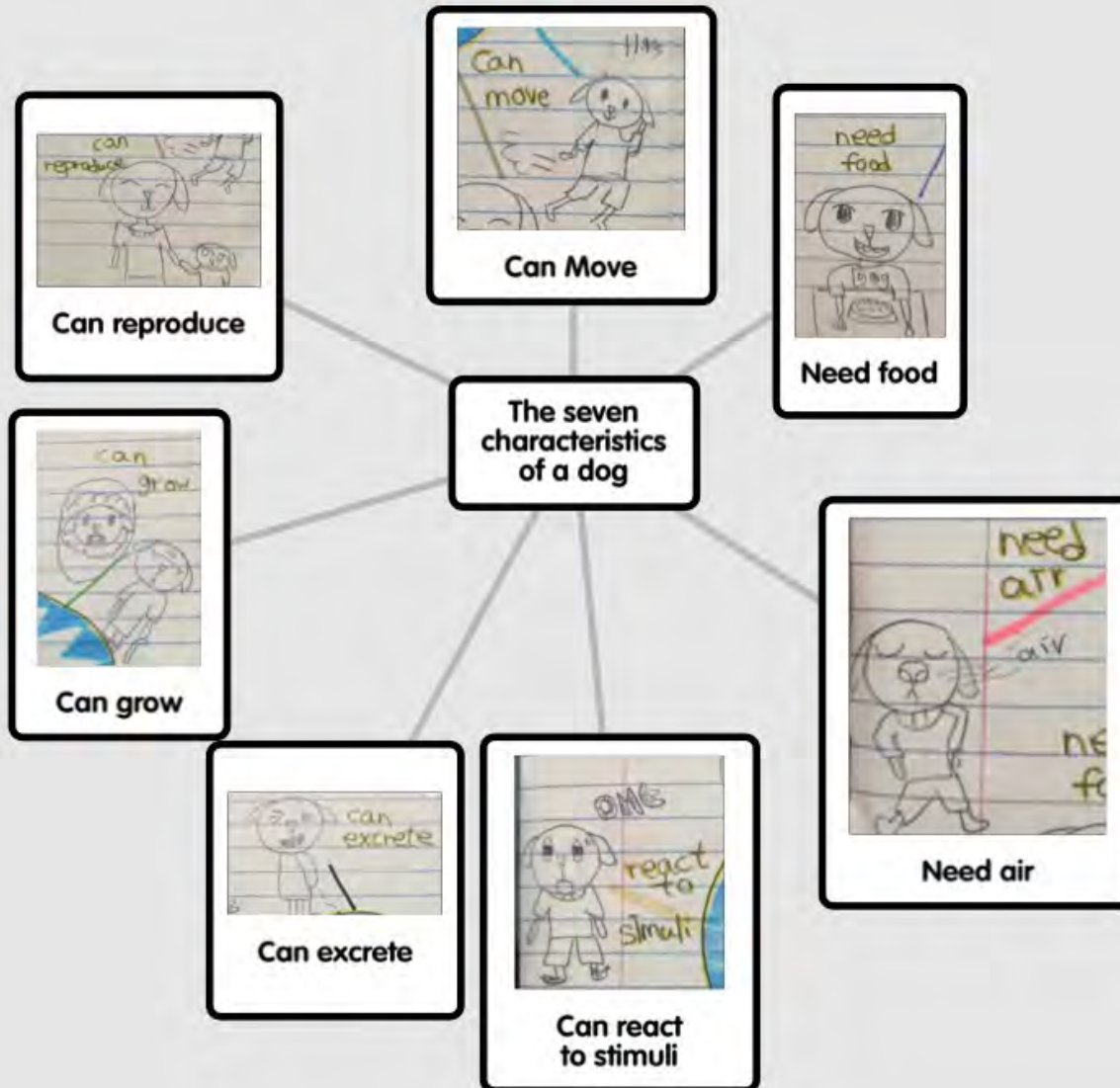


# Popplets--Conclusion: Mind-Map



# Chapter Summary :

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# Visual Sketchnotes

Rule 4:

Practice 😊  
everyday

➡ #Everyone

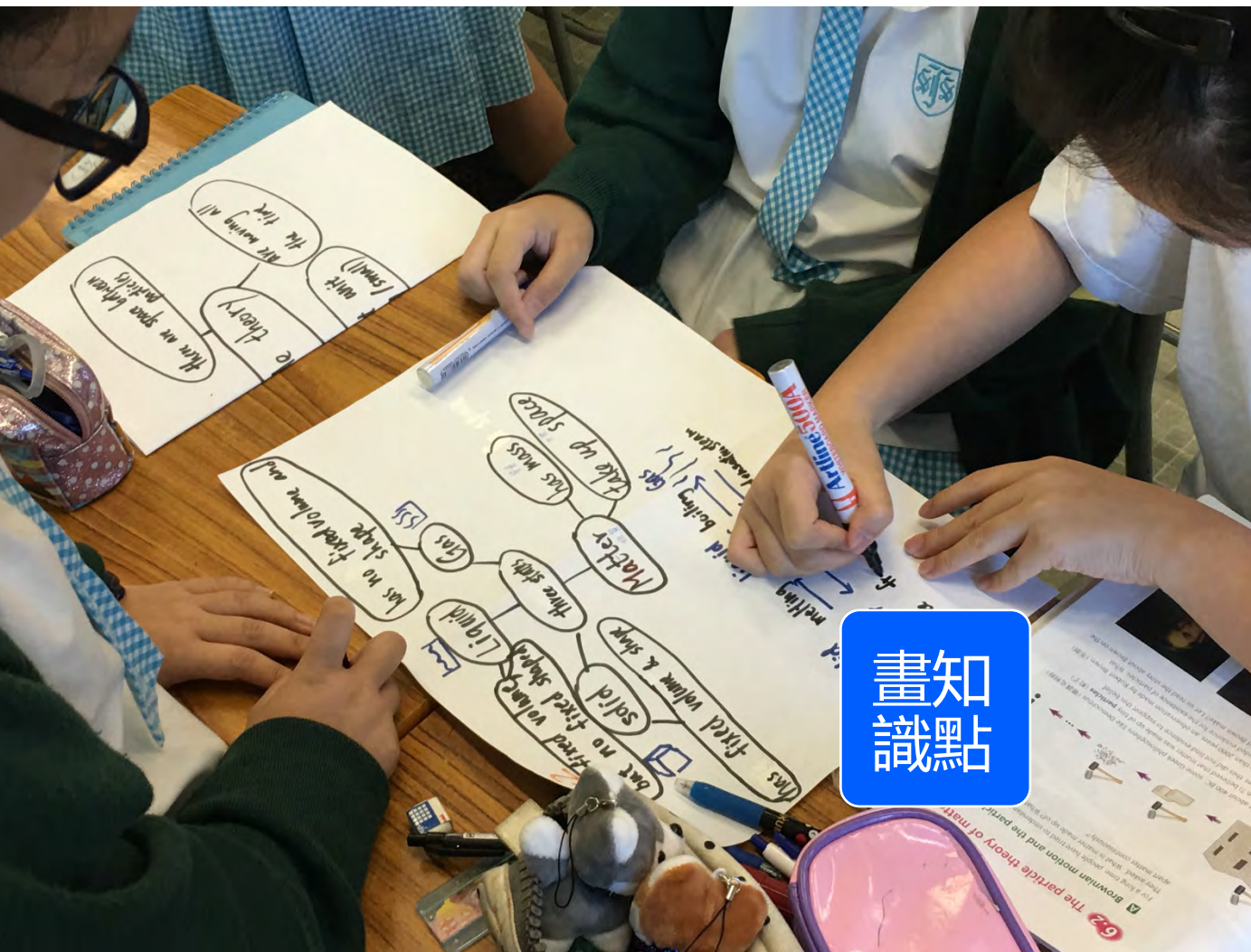
~~I cannot  
Draw!!~~

Can  
create !! 😊

- ✓ Planner
- ✓ Bookreport
- ✓ Notes
- ✓ Lesson Review
- ✓ TED Talk



# 視覺筆記在溫習中的應用-科學科





# 視覺筆記在溫習中的應用-科學科



學生  
思考



視覺筆記作  
總結

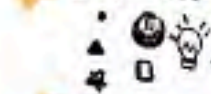
# MAKING Learning Visible:

## Visual Sketchnotes by Viansin @ 2019



### Visual Elements

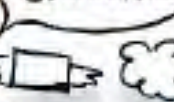
Bullets



Arrows



Containers



Colours



# Everyone can create Drawings

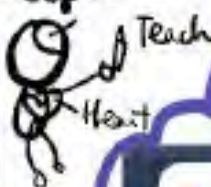
Face



People



Concepts

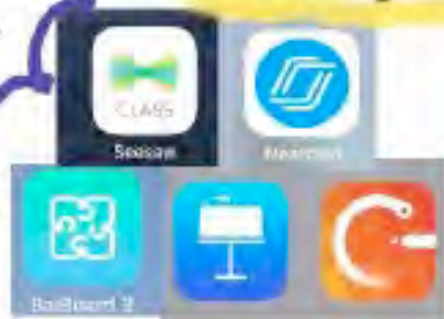


### Rules :

1. It is NOT ART!
2. DARE to draw!
3. SHARE with Others
4. Practice more!

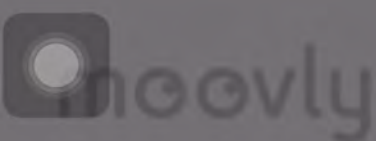


### Learning apps

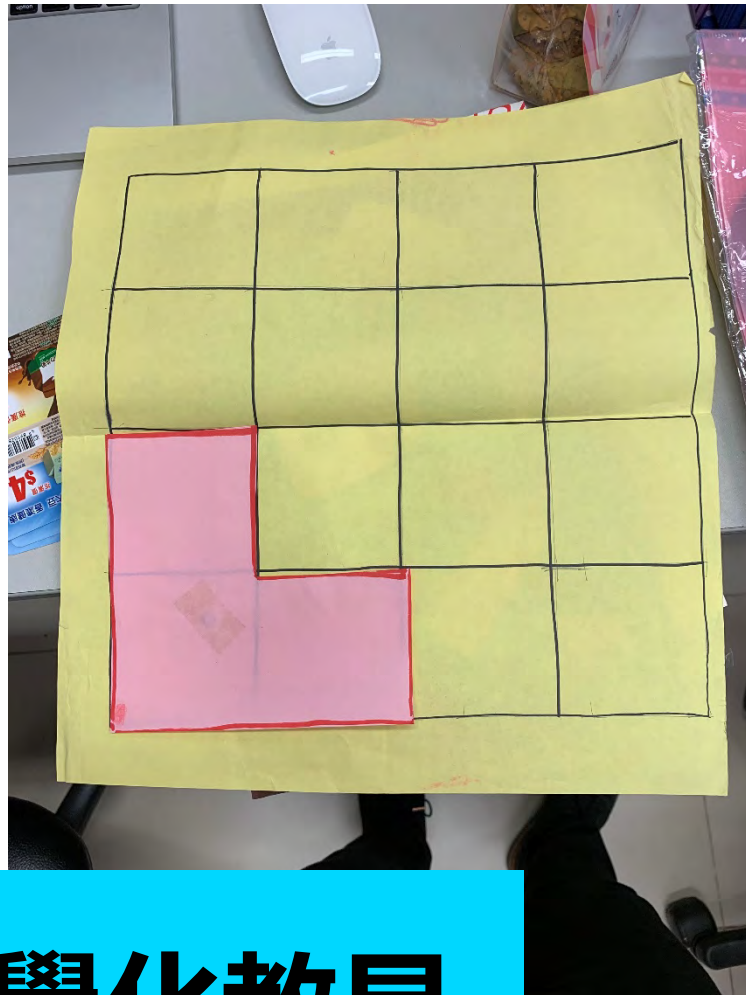
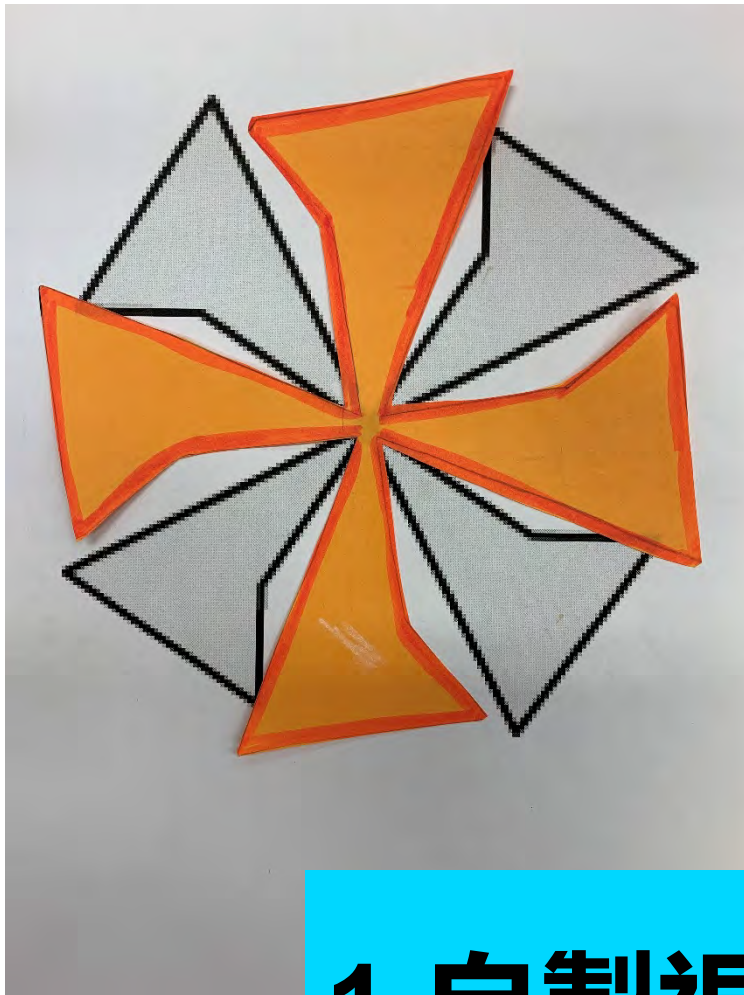




the demands of the 21st Century labour market?



# 視覺筆記在溫習中的應用-數學科



## 1. 自製視覺化教具

# 視覺筆記在溫習中的應用-數學科

Visual notes on geometry topics, including parallel lines, congruence, and similar triangles, displayed on a whiteboard and green chalkboard.

**Angles relating to Parallel lines**

- ① corr.  $\angle$ s,  $AB \parallel CD$   
F A  $\rightarrow$  B  $\angle a$   $\angle b$   $a = b$
- ② alt.  $\angle$ s,  $AB \parallel CD$   
Z A  $\rightarrow$  B  $\angle a$   $\angle b$   $a = b$
- ③ int.  $\angle$ s,  $AB \parallel CD$   
C A  $\rightarrow$  B  $\angle a$   $\angle b$   $a + b = 180^\circ$

**Prove Parallel lines**

- ① corr.  $\angle$ s equal  
if  $\angle a = \angle b$ , then  $AB \parallel CD$
- ② alt.  $\angle$ s equal  
if  $\angle a = \angle b$ , then  $AB \parallel CD$
- ③ int.  $\angle$ s supp.  
if  $\angle a + \angle b = 180^\circ$ , then  $AB \parallel CD$

**Congruence 全等**

- ① SSS (邊邊邊)
- ② SAS (邊角邊)
- ③ AAS (角角邊)
- ④ ASA (角邊角)
- ⑤ RHS (直角, 斜邊, 邊)

**Similar 相似**

- ① AAA (角角角)
- ② 3 sides proportional  
 $\frac{AB}{XY} = \frac{BC}{YZ} = \frac{AC}{XZ}$
- ③ Ratio of 2 sides, inc.  
 $\frac{AB}{XY} = \frac{BC}{YZ}$  AND  $\angle B = \angle Y$

**Distance 距離 / length 長度**  
 $= \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

**Slope 斜率**  
 $= \frac{y_1 - y_2}{x_1 - x_2}$

**Angles relating to Intersecting lines**

- ① Adj  $\angle$ s on st line  
 $a + b = 180^\circ$
- ② ext.  $\angle$  of  $\Delta$   
 $a + b = c$
- ③ base  $\angle$ s,  $\Delta$
- ④ Sides opp. eq.  $\angle$ s
- ⑤ Prop. of  $\Delta$

**Angles relating to Triangles  $\Delta$**

- ①  $\angle$  sum of  $\Delta$   
 $a + b + c = 180^\circ$
- ② ext.  $\angle$  of  $\Delta$   
 $a + b = c$
- ③ base  $\angle$ s,  $\Delta$
- ④ Sides opp. eq.  $\angle$ s
- ⑤ Prop. of  $\Delta$

**已知 / 已証 全等  $\Delta$**   
所以  
邊一樣 corr. sides,  $\cong \Delta$ s  
角一樣 corr.  $\angle$ s,  $\cong \Delta$ s

**已知 / 已証 相似  $\Delta$**   
所以  
邊比例 same corr. sides,  $\sim \Delta$ s  
角一樣 corr.  $\angle$ s,  $\sim \Delta$ s

**Distance 距離 / length 長度  $\angle$ s at a pt.**  
 $a + b + c + d = 360^\circ$

**vert. opp.  $\angle$ s**  
 $a = b$

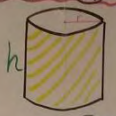
**If  $l_1 \parallel l_2$ , then  $m\angle 1 = m\angle 2$**   
**If  $l_1 \perp l_2$ , then  $m\angle 1 \times m\angle 2 = -1$**

## 2. 營造視覺複習場景，串聯要點



# 視覺筆記在溫習中的應用-數學科

Cylinder 圓柱體




Volume =  $\pi r^2 \times h$

Curved Surface Area =  $2\pi rh$

Total Surface Area =  $2\pi rh + 2(\pi r^2)$

Cone 錐體



Volume =  $\frac{1}{3} \pi r^2 h$

Curved Surface Area =  $\pi rl$

Total Surface Area =  $\pi rl + \pi r^2$

Prism: base area  $\times$  height

Pyramid:  $\frac{1}{3} \times$  base area  $\times$  height

$r$ : radius 半徑  
 $d$ : diameter 直徑  
 $C$ : circumference 圓周長

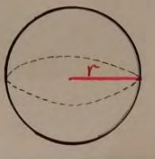
$C = \pi d$  or  $C = 2\pi r$

Area =  $\pi r^2$

Arc length =  $2\pi r \times \frac{\theta}{360}$

Sector Area =  $\frac{\pi r^2 \theta}{360}$

Sphere 球體



Volume =  $\frac{4}{3} \pi r^3$

Surface Area =  $4\pi r^2$

Angles relating to Parallel Lines

① Corr.  $\angle$ s,  $AB \parallel CD$   
 $\angle a = \angle b$

② alt.  $\angle$ s,  $AB \parallel CD$   
 $\angle a = \angle b$

③ int.  $\angle$ s,  $AB \parallel CD$   
 $\angle a + \angle b = 180^\circ$

Angles relating to Intersecting Lines

① Adj.  $\angle$ s on st. line  
 $\angle a + \angle b = 180^\circ$

②  $\angle$ s at a pt.  
 $\angle a + \angle b + \angle c + \angle d = 360^\circ$

③ vert. opp.  $\angle$ s  
 $\angle a = \angle b$

Angles relating to Triangles

①  $\angle$  sum of  $\Delta$   
 $\angle a + \angle b + \angle c = 180^\circ$

Angles relating to Triangles

①  $\angle$  sum of  $\Delta$   
 $\angle a + \angle b + \angle c = 180^\circ$

② ext.  $\angle$  of  $\Delta$   
 $\angle a + \angle b = \angle c$

③ base  $\angle$ s,  $\Delta$   
 $\angle a = \angle b$

④ sides opp. eq.  $\angle$ s  
 $\angle a = \angle b$

factorization

① take out common factor  
 抽相同

② Grouping terms  
 分組

③ Identity  $a^2 - b^2 \equiv (a+b)(a-b)$   
 恆等式

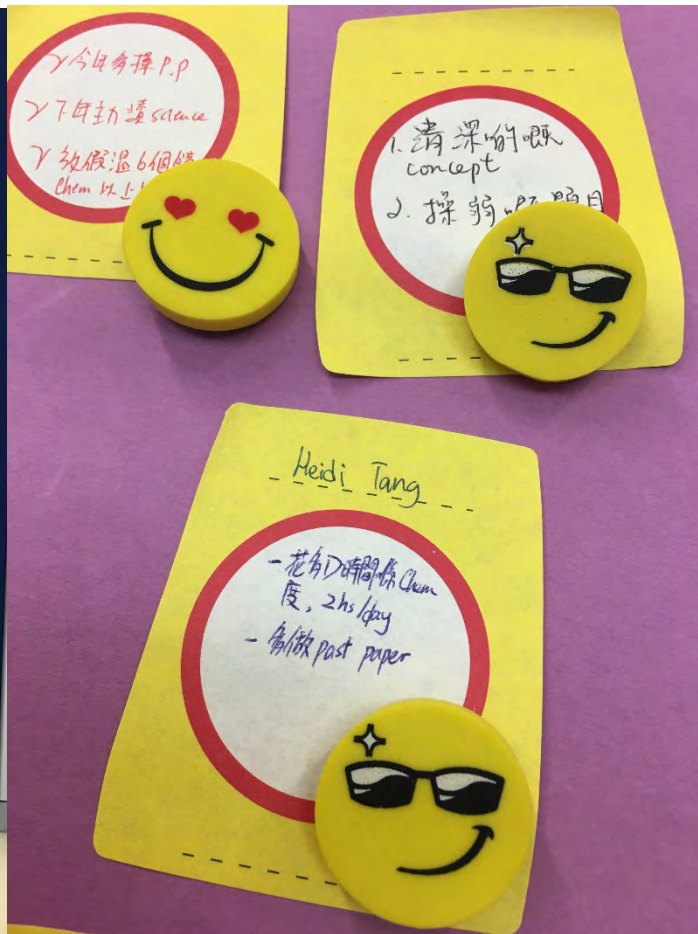
④ Cross method  
 十字相乘法

## 2. 營造視覺複習場景，串聯要點



# 視覺引導的其他的應用-

## 成長思維心法



# 鼓勵反思, 提升自我

# "The CHALLENGES for 21st Century TEACHERS"

? future education

