INTEGRATING CONTENT AND LANGUAGE LEARNING IN EMI EDUCATION ---EXPLORING "THEMATIC PATTERNS" AS PEDAGOGICAL STRATEGIES

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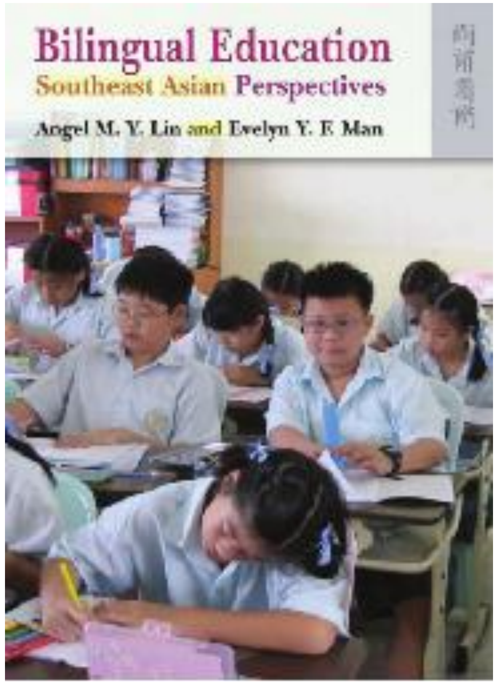
Overview

- Background
- Literature review
- Methodology
- Results
- Discussion
- Limitation
- Implication



Unfavourable conditions in English as the Medium of Instruction (EMI) schools in Hong Kong

(Lin & Man, 2009)

- inadequate English skills of the students
- lack of language support
- lack of professional development opportunities for teachers
- lack of Language-Across-the-Curriculum (LAC) co-ordination
- unsuccessful Bridging Courses

Exam culture & Rote-learning

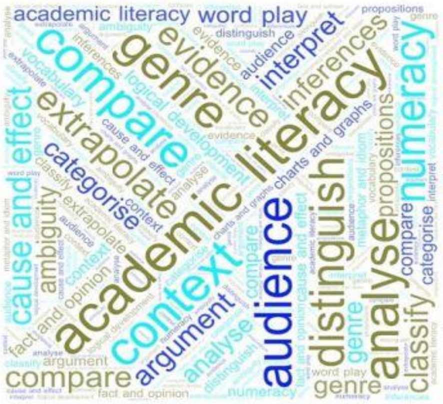
"The students are really well-motivated
and self-disciplined"
("自覺讀（背）書").

"Once I get the (Science) notes, I'll
recite all of them, the more words
the better, I'll treat them as if I am
learning Chinese History..."

EMI Education

"**Foreign Language**": content subjects taught in English as an additional language (EAL)

"Foreign L anguage": the challenges from academic subject literacy



- Learning science is virtually learning a "**foreign language**" (Wellington & Osborne, 2001)
- Foreign language "**squared**"(Lin, 2016)

Content and Language Integrated Learning (CLIL) in EMI education

To help students to learn the (science) subjects in a meaningful way by enhancing both their **academic content awareness** and **academic language awareness**

CLIL

- **C**ontent and **L**anguage **I**ntegrated **L**earning (CLIL) is an educational approach where students learn non-language content subjects through a second/foreign/additional language (Coyle, Hood & Marsh, 2010).

- Previous CLIL studies have mainly focused on its various definitions, language and content learning outcomes as well as pedagogical issues (Cenoz, Genesee, & Gorter, 2013; Dalton-Puffer & Nikula, 2014; Lin, 2016; Llinares & Lyster, 2014).

- Recent studies start to investigate CLIL teacher education (Cammarata & Ó Ceallaigh, 2018)

  -CLIL teachers' knowledge about language (Morton, 2018)

  -CLIL teacher professional identities (Dale, Oostdam & Verspoor, 2018)

  -CLIL teacher language awareness (He & Lin, 2018)

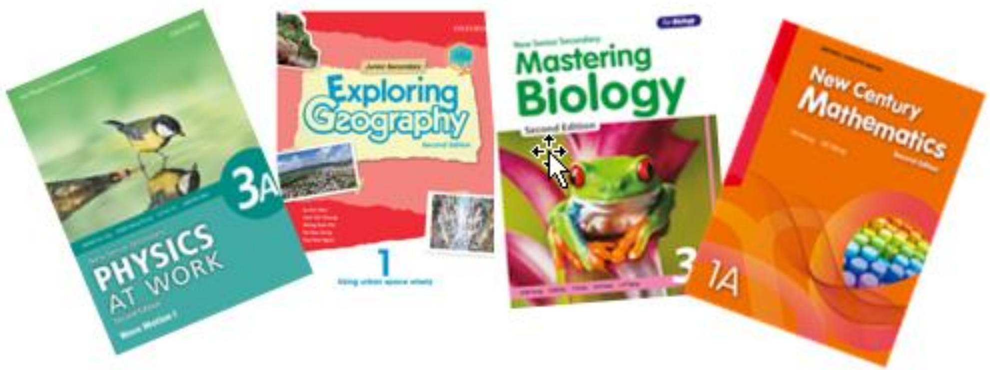
Research Gap

While there is no denying that CLIL involves the teaching of both content and language, it remains a challenge to achieve pedagogical **integration** of content and language in CLIL classrooms (Dalton-Puffer, 2018; Lin, 2016; Ruiz de Zarobe, 2016).

Concept instruction and language

Concepts are fundamental in all content subjects, but they are difficult to learn because of their abstractness and complexity.

Traditional (science) pedagogy privileges the notion of "**concepts**" but neglects the role played by **language**.



Concept mapping

- **Concepts** are “perceived regularities or patterns in events or objects, or records of events or objects, designated by a label” (Novak, et al., 1983, p. 625).

- Novak developed the idea of **“cognitive maps”** or **“concept maps”** (Novak et al., 1983). Although **concept mapping** is believed to facilitate **meaningful learning** by constructing a spatial and visual representation of interconnected concepts and the hierarchical structure of conceptual knowledge in the human mind, concept maps which “strip away all text except for concept labels” may lead to the “**lack of clarity** for most people” (Novak, 2010, p. 32).

The **mentalistic representations** of concepts **"lack the necessary vocabulary"** (Lemke, 1998) to inform teachers how they should guide their students to learn and apply the concepts correctly.

Concepts are mediated by **thematic patterns**. What science teachers typically do in the classroom is in fact exposing students repeatedly to the '**thematic patterns**' (Lemke, 1990).

Thematic-pattern-based Concept + Language Mapping

The theory of "thematic patterns"

"The pattern of connections among the meanings of words in a particular field of science I will call their **thematic pattern**. It is a pattern of semantic relationships that describes the thematic content, the science content, of a particular topic area. It is like a network of relationships among the scientific concepts in a field, but described semantically, in terms of how language is used in that field" (Lemke, 1990, p.12).

"Talking science is not the totality of doing science. But very little science gets done, or could get done, without the **semantic resources of language**, and particularly the **thematic patterns** and **genre structures** specific to science"…

...Reasoning is combing the use of **thematic pattern** with the use of a rhetorical or **genre structure pattern**. One supplies the **content**, the other supplies the **form** of organization of the argument" (p. 122-123).

Thematic patterns, semantic relations and thematic items (Lemke, 1990)

are key **terms** or **concept** words

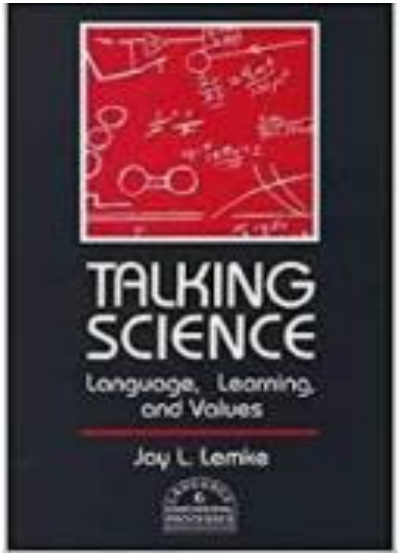
refer to the **relations** between the **thematic items**

Thematic pattern is a **pattern** of **semantic relationships** that describes the **thematic content** of a particular content area.

describe how the **meanings** of two **thematic items** are related when they are used together in talking about a particular topic

include

- ***Nominal relations*** e.g. attributive, classifier, quantifier, etc.
- ***Taxonomic relations*** e.g. token, hyponym, meronym, synonym, antonym, etc.
- ***Transitivity relations*** e.g. agent, target, medium, beneficiary, range, identification, possession, etc.
- ***Circumstantial relations*** e.g. location, time, material, manner, reason, etc.
- ***Logical relations*** e.g. elaboration, addition variation, connection, etc.
- and other relations, etc.



Global thematic strategies (Lemke, 1990, p.227)

Repetition with variation

"One or more repeats of the same partial thematic pattern, each with some items and relations similarly expressed and other differently expressed. Enables abstraction of pattern and flexible expression."

Condensation

"Assigning a pattern of thematic items and their semantic relationships to a single new thematic item, that is, naming or designating the pattern. Condensations are then more easily connected to other themes."

Thematic nexus

"The bringing together of themes expressed in different parts of the lesson or text into a single structural unit; a synthesis."

Theme-weaving (cohesive harmony)

"Establishing patterns of thematic interconnection by introducing thematic items and relations and bring them together in different combinations across the lesson or text; usually leads to one culminative or through more than one intermediate thematic nexus."

Intertextual allusion

"Establishing thematic relationships by implicitly or explicitly invoking a thematic pattern which is not explicitly expressed in the lesson or text, but which is known to the participants or can be located in some other text or occasion of discourse."

A Photosynthesis

PowerPoint 7.4

Through eating, we obtain energy for carrying out various body activities. However, plants do not eat like us. How do green plants get their energy for growth?

Green plants can make their own food. They take in **carbon dioxide** and **water** from the surroundings, and build them into food using **light energy**. The light energy is absorbed by a green pigment (色素) called **chlorophyll** (葉綠素) inside the chloroplasts (葉綠體) in green plant cells. The food produced is usually **starch** (澱粉). **Oxygen** is also produced as a **by-product** (副產品) during the process (Fig 7.8).

This process of making food in green plants is called **photosynthesis** (光合作用). It can be summarized by the word equation below.

carbon dioxide + water —(light energy / chlorophyll)→ food (starch) + oxygen

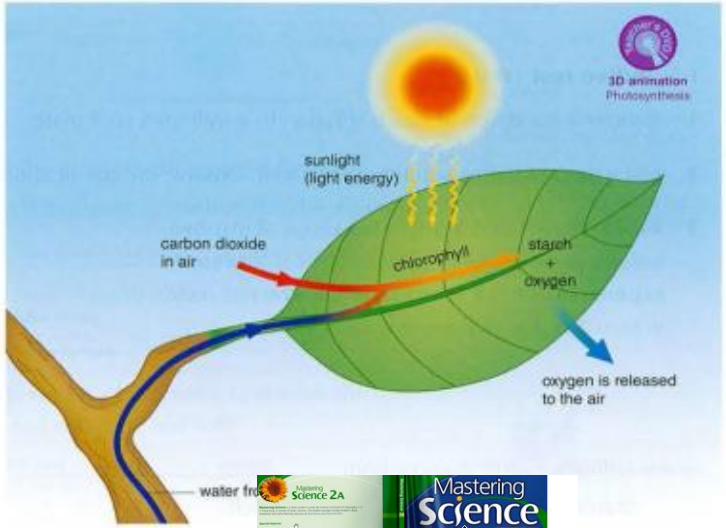


Fig 7.8 The process of photos

Oxford 2A:
Mastering Science
(Teacher's Edition p.31)

A. The process of photosynthesis

Green plants make their own food by **photosynthesis**. It is a complicated process. Below are four main aspects of photosynthesis:

1. **Raw materials***: The raw materials are carbon dioxide and water. Carbon dioxide is obtained from the air. Water is obtained from the soil.
2. **Energy source**: Light energy is required in the process. It is absorbed by chlorophyll* in the green leaves and other green parts of the plants.
3. **Product**: The food produced is usually stored in form of starch*. The chemical energy stored in the food is converted from the light energy absorbed by chlorophyll.
4. **By-product***: Oxygen is also produced and is released into the air.

To summarize, green plants absorb light energy by chlorophyll to produce food from carbon dioxide and water. Oxygen is formed as a by-product. The process of photosynthesis can be represented by the word equation below:

carbon dioxide + water —(light energy / chlorophyll)→ food (starch) + oxygen

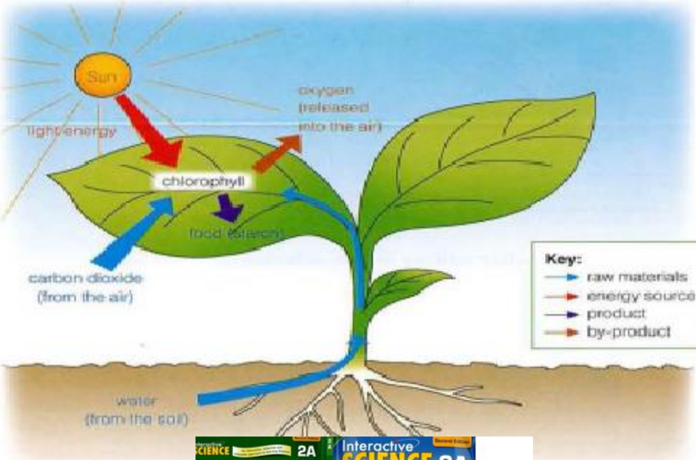
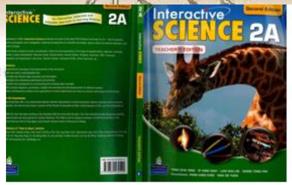


Fig. 7.12 The process



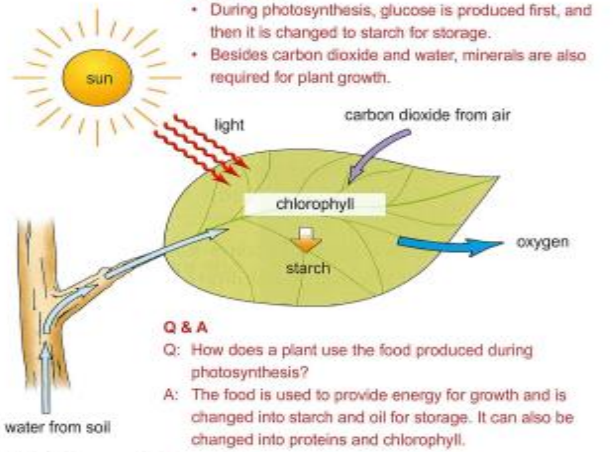
Longman 2A:
Interactive Science
(Teacher's Edition p.35)

A. Photosynthesis

Green plants make their own food by the process of **photosynthesis**. During photosynthesis, green plants use carbon dioxide and water as the raw materials, and the energy from sunlight to make their own food. The food is stored in the form of **starch**. Oxygen is also produced as a *by-product*.

The carbon dioxide needed for photosynthesis is obtained from the air and the water is absorbed from the soil. The sunlight is absorbed by **chlorophyll** in the green parts of the plants (Fig. 7.9).

Teaching notes
- During photosynthesis, glucose is produced first, and then it is changed to starch for storage.
- Besides carbon dioxide and water, minerals are also required for plant growth.



Q & A
Q: How does a plant use the food produced during photosynthesis?
A: The food is used to provide energy for growth and is changed into starch and oil for storage. It can also be changed into proteins and chlorophyll.

Fig. 7.9 Process of photosynthesis

The following is a simplified equation representing the process of photosynthesis:

carbon dioxide + water —(light energy / chlorophyll)→ starch + oxygen

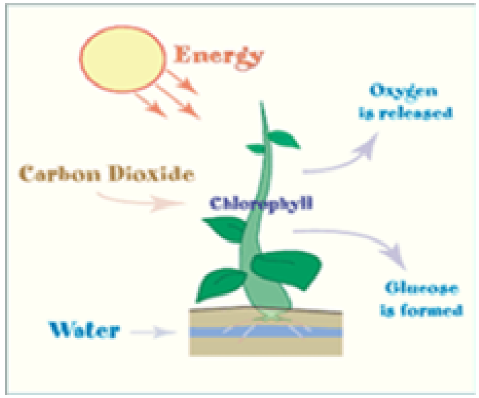
ARISTO 2A:
Understanding Integrated Science
(Teacher's Edition p.31)

Repetition with variation

Intertextual allusion

Thematic pattern, condensation, thematic nexus and theme-weaving

Photosynthesis (光合作用) is the process by which green plants make food from carbon dioxide and water using light energy.



The semantic relations in the definition "photosynthesis"

1. PHOTOSYNTHESIS is a PROCESS [**Token / Type**]

2. GREEN PLANTS make FOOD [**Agent / Process / Target**]

- -by PHOTOSYNTHESIS [**Circumstance**: manner]
- -from CARBON DIOXIDE and WATER [**Circumstance**: material]
- -using LIGHT ENERGY [**Circumstance**: condition]

An example of a thematic pattern

Photosynthesis is important
[**Carrier / Attribute**]

because
[**logical relation**: Cause/ Consequence]

it produces food (starch) ***and*** releases oxygen for all living things.

[**Agent / Process / target**] [**logical relation**: Item/ Addition] [**Process / target**] [**Circumstance**: beneficiary]

Meaning making in the classroom: synergistic integration of semiotic resources

- "**The 'concepts' of science** are not verbal concepts...They are **semiotic *hybrids***, simultaneously and essentially verbal-typological and mathematical-graphical-operational-topological" (Lemke, 1993).

- "The **natural language of science** is a **synergistic integration** of words, diagrams, pictures, graphs, maps, equations, tables, charts, and other forms of visual and mathematical expression" (Lemke, 1998).

- "**Rainbow Diagram**" (Lin, 2012, p. 93)

- Learning from **animated concept maps** with concurrent **audio narrations** (Nesbit & Adesope, 2011)
- The importance of a **consistent diagrammatic** and **verbal representation** in communicating scientific ideas (Cheng & Gilbert 2015)

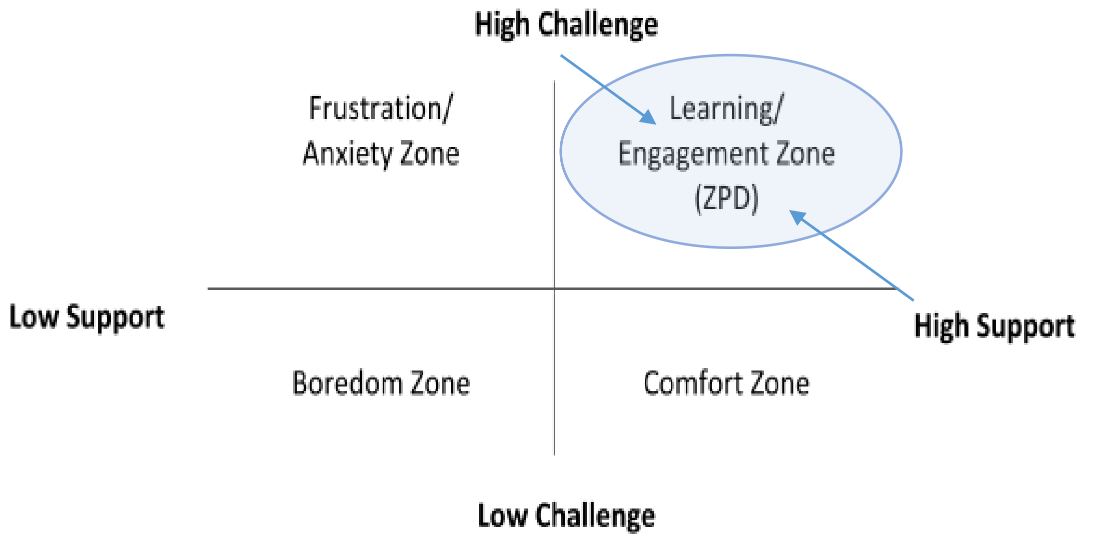
Communicative activities and Communicative approaches

"…..the fundamental sense of literacy in science is the ability of an individual to construct meaning through interaction with the multiple forms of semiotic communication that are used within the discipline of science. Indeed, the five major communicative activities of science can be seen as **writing science, talking sciences, reading science, "doing" science**, and **representing scientific ideas** "(Osborne, 2014, p.591).

Four kinds of communicative approaches
(Mortimer & Scott, 2003, p.35-39)

	INTERACTIVE	NON-INTERACTIVE
DIALOGIC	**A** Interactive/dialogic	B Non-interactive/dialogic
AUTHORITATIVE	C Interactive/authoritative	D Non-interactive/authoritative

Designed/Planned scaffolding vs **Interactional/Spontaneous scaffolding** (Gibbons, 2009; Lin, 2016)



(Gibbons, 2009, adapted from Mariani, 1997)

Designed/planned scaffolding: the support teachers consciously plan in advance.

Spontaneous/Interactional scaffolding:
the support teachers provide contingently through dialogue during instruction or other interaction

Research Questions

1. Does the CLM approach facilitate development of both content knowledge and language knowledge in EMI classrooms?

2. How does the CLM approach affect the process of content and language knowledge development in EMI classrooms?

Research design

"Development Research" Framework
(Reeves, 2000)

pre-intervention interviews with teachers probing teaching and learning challenges

thematic-pattern-based **CLM materials designed** by the researchers and **reviewed** by teachers

CLM materials tried out by participating teachers who decided on which materials to use and when to use them

teachers and researchers **co-reflected** on the CLM pedagogy and improved it in an ongoing process.

Concurrent triangulation mixed methods
(Creswell, 2003)

- naturalistic observation
- semi-structured interviews
- documents
- quasi-experimental design

Summary of research sites and participants

Schools	MOI	Banding	Grade	Subjects	No. of students	Included (Y/N)	Remarks
School 1	EMI	Band I	S1	Junior Geography	31	**Y**	
	EMI	Band I	S2	Integrated Science	29	**Y**	
	EMI	Band I	S2	Junior Geography	30	**Y**	
	EMI	Band I	S3	Biology	30	**Y**	
	EMI	Band I	S4	Senior Geography	20	**N**	There was only one class in S4 Geography. Control class was not available.
	EMI	Band I	S4/5	Biology	28	**Y**	There was only one class in S4 Biology. The S4 (intervention class) and S5 (control class) Biology teachers taught the same topic during the intervention period.
School 2	EMI	Band III	S5	Biology	16	**N**	There was only one class in S4 Biology. Control class was not available.
School 3	CMI	Band III	S3	Integrated Science	19	**N**	This project focused on EMI classrooms.
	CMI	Band III	S1	Integrated Science	19	**N**	
School 4	CMI	Band III	S2	Integrated Humanity	31	**N**	
	CMI	Band III	S1	Integrated Science	24	**N**	

Details of participants

	Intervention Class	Control Class
MOI; grade; subject; number of students; subject teacher; number of lessons during intervention	EMI S1 (Grade 7) Junior Geography N=31 Ms C 7 lessons	EMI S1 (Grade 7) Junior Geography N=33 Ms C 7 lessons
	EMI S2 (Grade 8) Integrated Science N=30 Mr H 7 lessons	EMI S2 (Grade 8) Integrated Science N=30 Mr H 7 lessons
	EMI S2 (Grade 8)Junior Geography N=29 Ms L 3 lessons	EMI S2 (Grade 8)Junior Geography N=29 Ms L 3 lessons
	EMI S3 (Grade 9)Biology N=30 Ms S 8 lessons	EMI S3 (Grade 9)Biology N=27 Another teacher 8 lessons
	EMI S4 (Grade 10) Biology N=28 Ms T 8 lessons	EMI S5 (Grade 11) Biology N=30 Another teacher 8 lessons
L1 of students	Cantonese	Cantonese
English language proficiency	• above-average among same-grade students in the city	• above-average among same-grade students in the city
Learning attitudes	• well motivated with good learning attitude	• well motivated with good learning attitude
Teacher background	• The L1 of the participating teachers is Cantonese, but they are all qualified EMI teachers and are experienced in teaching the content subjects. • Mr H teaches both Integrated Science and English language subjects. • All teachers participated in the project for first time.	
Pre-/post tests	taken on the same day	
Teaching resources	tried out during intervention	not available

Thematic-pattern-based "C+L Mapping" pedagogy

- **"Concept + Language" teaching/learning materials**

  -C+ L Cards
  -C + L Maps
  -C + L supporting materials:
    e.g. sentence-making tables, experiment report template, essay writing guides, etc.

- **"Concept + Language" teaching/learning activities**

  -collaborative learning:
    e.g. discussions, experiments, debates, games
  -self-directed learning:
    e.g. completing worksheet, experiment report, home assignments, etc.

CLM Scaffolding:
C+L Card

photosynthesis

photosynthesis (光合作用): the process by which **green plants** make food from **carbon dioxide** and **water** using **light** energy

Language knowledge:

photo-synthesis

photo: "light"

Synthesis (綜合體): "the combining of constituent elements (構成成分) of separate materials into a unified entity (統一的實體)"

Biology + Language knowledge:

•**Photosynthesis** is important *because* it produces food (**starch**) and releases **oxygen** for all living things.

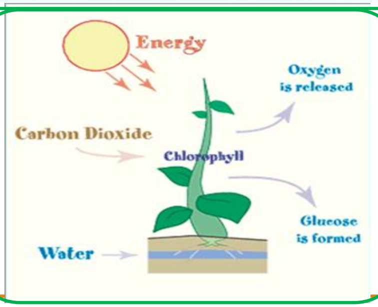
•**Green plants** make their own **food** by **photosynthesis**.

•**Chlorophyll, light, carbon dioxide** and **water** are needed for **photosynthesis** during which **Carbon dioxide** and **water** are consumed *while* **food (starch)** and **oxygen** are produced.

•During **photosynthesis,** green plants convert **light energy** to **chemical energy** stored in the **food produced.**

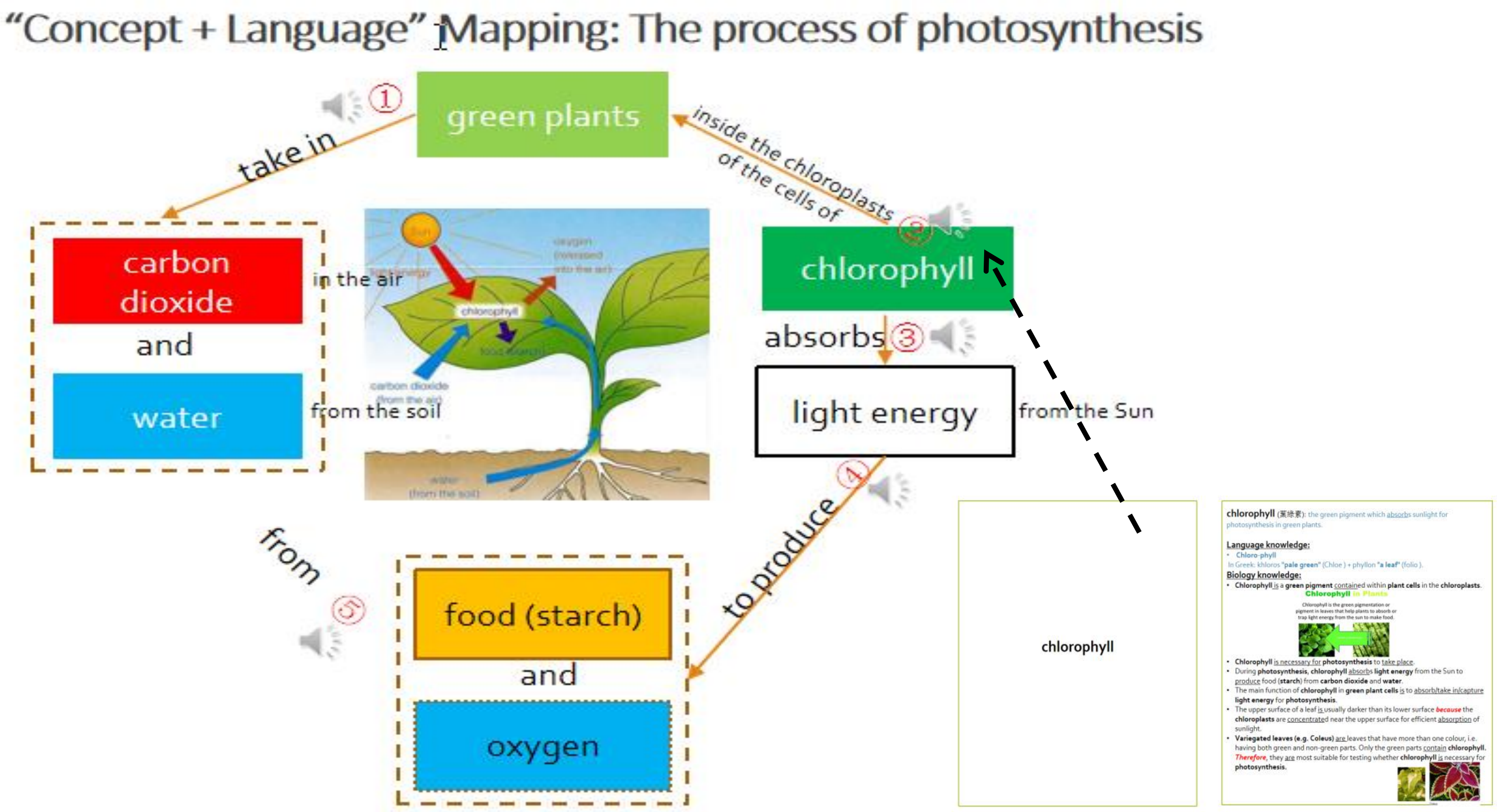
•**Photosynthesis** is important in maintaining the balance of **oxygen** and **carbon dioxide** in the atmosphere.

$$\text{carbon dioxide} + \text{water} \xrightarrow[\text{chlorophyll}]{\text{light energy}} \text{food (starch)} + \text{oxygen}$$

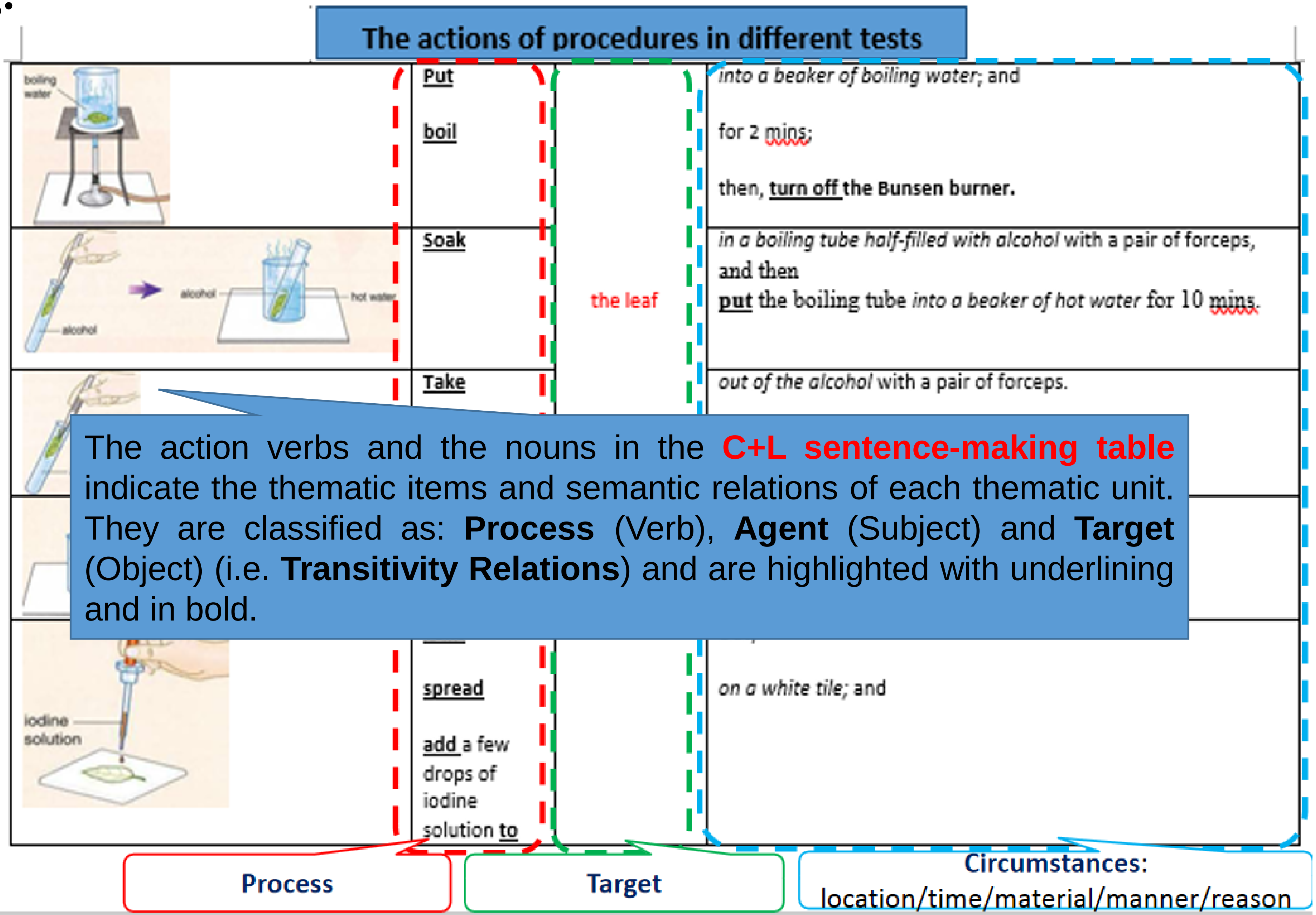


CLM Scaffolding:

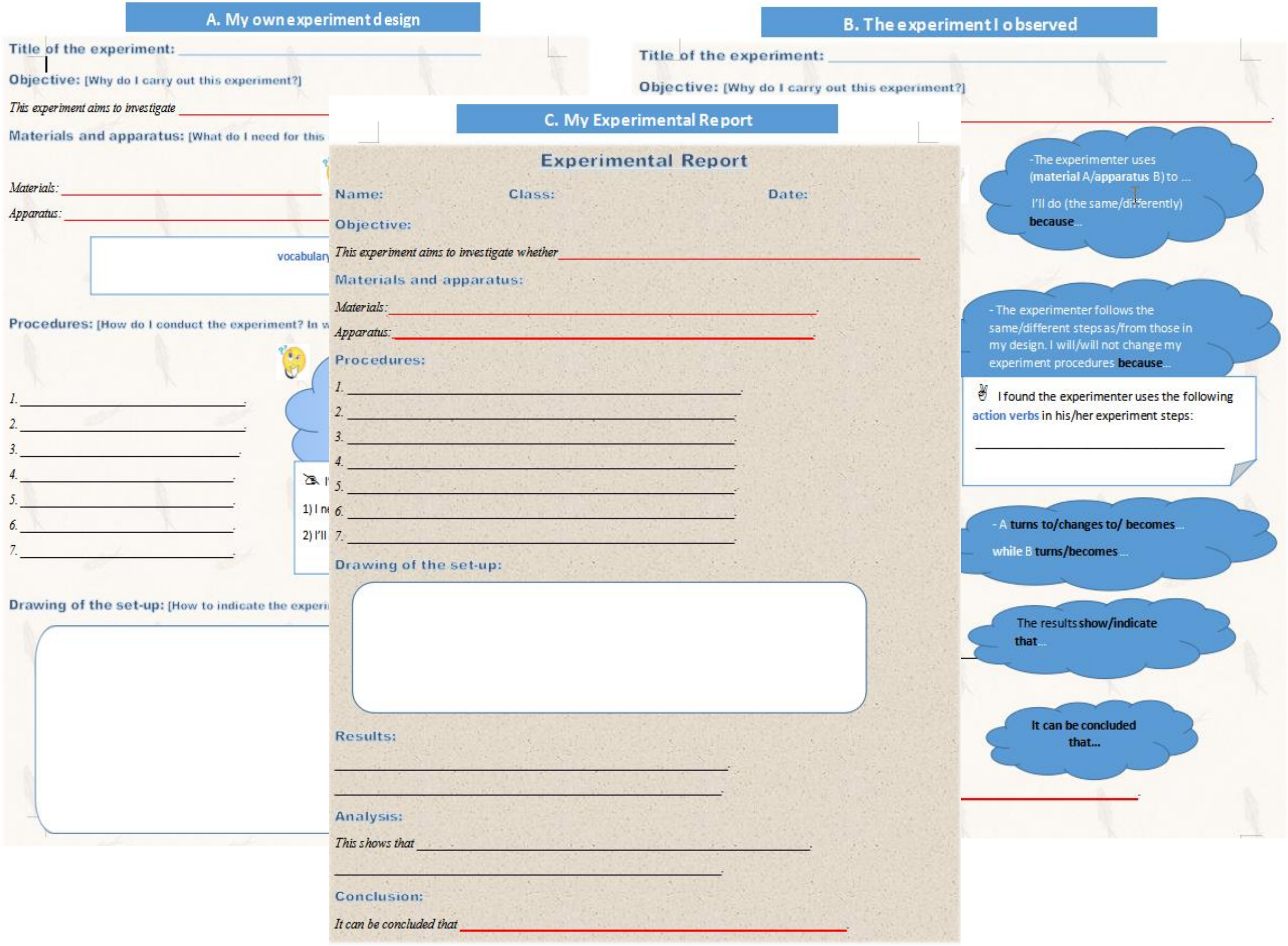
C+L Map



CLM Scaffolding: C+L sentence-making table



The action verbs and the nouns in the **C+L sentence-making table** indicate the thematic items and semantic relations of each thematic unit. They are classified as: **Process** (Verb), **Agent** (Subject) and **Target** (Object) (i.e. **Transitivity Relations**) and are highlighted with underlining and in bold.



CLM Scaffolding: C+L writing guide

DNA is well suited to its function as the genetic material:

- DNA is a **stable** molecule.
- The base sequences form the **genetic code**.
- A DNA molecule can carry a **large amount of genetic information**.
- DNA can **replicate** accurately so that the same genetic information can be passed to new cells.

Bullet-point notes in the science textbook.

Add an **introduction** referring to the question

Provide **supporting details** to make your arguments *solid*.

Use **sequencial conjunctions** to make your argument *clear*.

Use **logical connectors** (e.g. cause & effect) to make your arguments *logical*.

Use **academic words** (e.g. 'replicate' instead of 'copy') to make your arguments *scientific*.

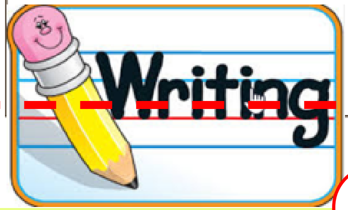
The **structure** of **DNA** is well suited to its **function** as a **genetic material** ***because of*** **the following aspects:**

First, DNA molecule consists of a large number of nucleotides. ***Therefore***, it carries a large amount of genetic information.

Second, ***since*** DNA molecule has a long sequence of bases to form genetic code, it stores a large amount of genetic information.

Third, DNA is a stable molecule ***because*** it has strong sugar-phosphate backbones and double helix structure maintained by the hydrogen bonds between the two strands.

Fourth, DNA can replicate itself accurately through complementary base pairing. ***As a result***, identical genetic information can be passed to the new cells from generation to generation.



The **C+L essay writing scaffolding** guides students to develop the bullet-point notes into the answer to an essay writing question (A DSE question type demanding for even Band I EMI students).

CLM Scaffolding:

C+L essay writing guide

Summary of quantitative and qualitative data

Class	Quantitative data	Qualitative data
S1 Junior Geography	• pre-test scores • post-test scores • control class N=33 • intervention class N=31	• lesson observation (videotape appr 245 mins) • focus group interview with students (audiotape appr 40mins) • semi-structured interview with Ms C (audiotape appr 30 mins) • student works of the try-out unit (intervention class N=31)
S2 Integrated Science	• pre-test scores • post-test scores • control class N=30 • intervention class N=30	• lesson observation (videotape appr 245 mins) • focus group interview with students (audiotape appr 30mins) • semi-structured interview with Ms C (audiotape appr 30 mins) • student works of the try-out unit (intervention class N=30)
S2 Junior Geography	• pre-test scores • post-test scores • control class N=29 • intervention class N=29	• lesson observation (videotape appr 105 mins) • focus group interview with students (audiotape appr 35mins) • semi-structured interview with Ms C (audiotape appr 40 mins) • student works of the try-out unit (intervention class N=29)
S3 Biology	• pre-test scores • post-test scores • control class N=27 • intervention class N=30	• lesson observation (videotape appr 280 mins) • focus group interview with students (audiotape appr 30mins) • semi-structured interview with Ms C (audiotape appr 45 mins) • student works of the try-out unit (intervention class N=30)
S4/5 Biology	• pre-test scores • post-test scores • control class N=30 • intervention class N=28	• lesson observation (videotape appr 280 mins) • focus group interview with students (audiotape appr 50mins) • semi-structured interview with Ms C (audiotape appr 50 mins) • student works of the try-out unit (intervention class N=28)

Finding 1

Results of **quantitative data analysis** indicated:

- in the post tests, the intervention classes **outperformed** the control classes in both content and language knowledge development;

- the **differences** were statistically **significant** when...

-both designed scaffolding and interactional scaffolding (Gibbons, 2009; Lin, 2016) were provided for the students during the EMI lessons, and

-content knowledge and language knowledge were integrated during the EMI lessons.

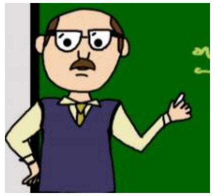
Finding 2

The **thematic-patterns-based CLM materials** were welcomed by the students and teacher who considered the CLM pedagogy helpful for learning the subjects in English as their additional language.

Feedback on CLM teaching materials

The C+L cards offered meaningful learning opportunities and helped students to clarify the meaning of the concepts.

The C+L cards built up networks of interrelated meaning about the concepts and provided more focused structures of their critical attributes that are scattered at different locations in the textbook.



The multimodal information helped students to better understand the concepts.

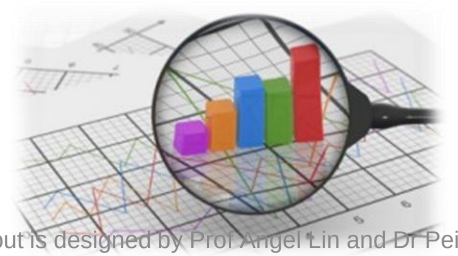
The language support was beneficial for students to better express the content knowledge.

Finding 3

The importance of **designed scaffolding** and **spontaneous scaffolding**

The thematic-pattern-based CLM approach enabled the teacher to guide the students to **better understand** and **inquire into the content knowledge** through both designed and spontaneous scaffoldings (Gibbons, 2009; Lin, 2016) in shifting communicative approaches (Mortimer & Scott, 2003).

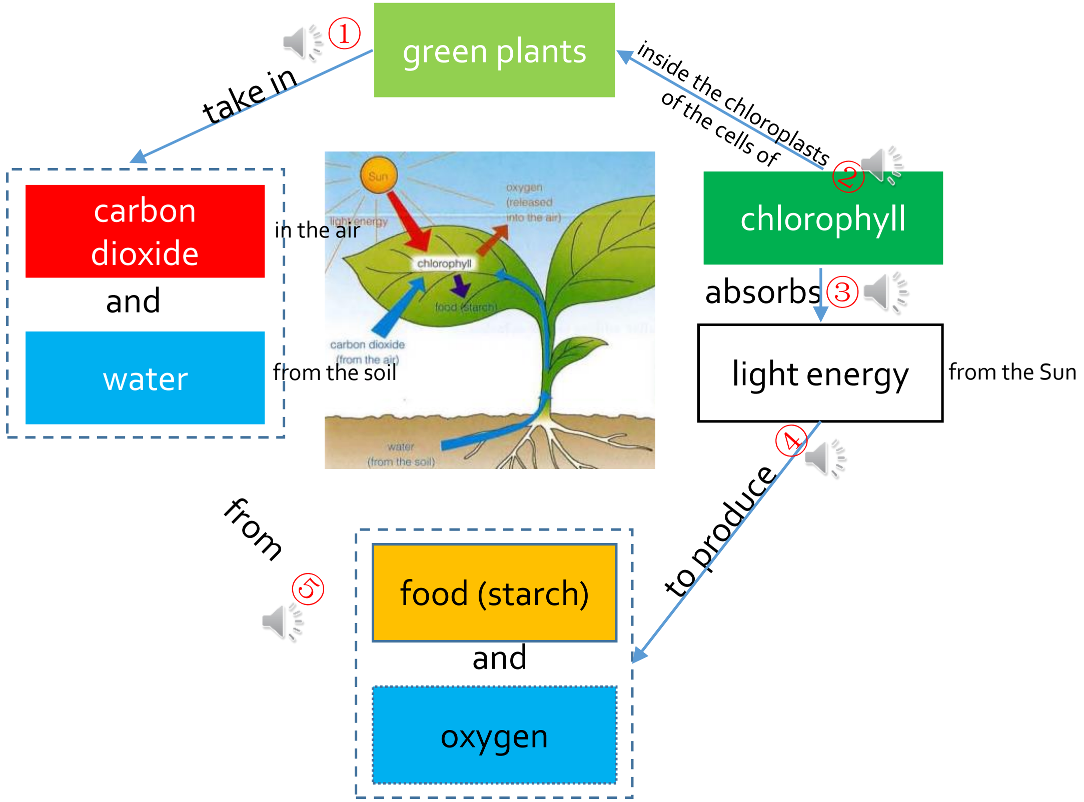
The thematic-pattern-based CLM materials and activities enhanced students' **motivation** to learn both the content and language knowledge actively through self-directed and collaborative learning.



CLM Scaffolding:

C+L Map

"Concept + Language" Mapping: The process of photosynthesis



	sentences
①	Green plants take in carbon dioxide in the air and water from the soil.
② ③ ④ ⑤	The chlorophyll inside the chloroplasts of the cells of green plants absorbs light energy from the Sun to produce food (starch) and oxygen from carbon dioxide and water.

S4: *The C+L maps on the PPT we saw during the lessons* ***made it easier for us the remember what we've learned****. I mean,* ***we don't need to recite everything in the book all the time.***

R: *What's the difference between a big map and the cards in different pieces?*

S4: *Well the maps are bigger when you read them* ***you don't just focus on a certain part****.*

R: *What is there between the different small parts?*

S5: ***There're connections.***

R: *Are there just arrow-connections or are there also some words in the connections?*

S5: ***There're words, which is good****. If there were only cards without connection, it would be time-consuming for us to search which concepts are linked with which and which one is being introduced.* ***It would be easier to remember what we've learned if we read the whole maps.***

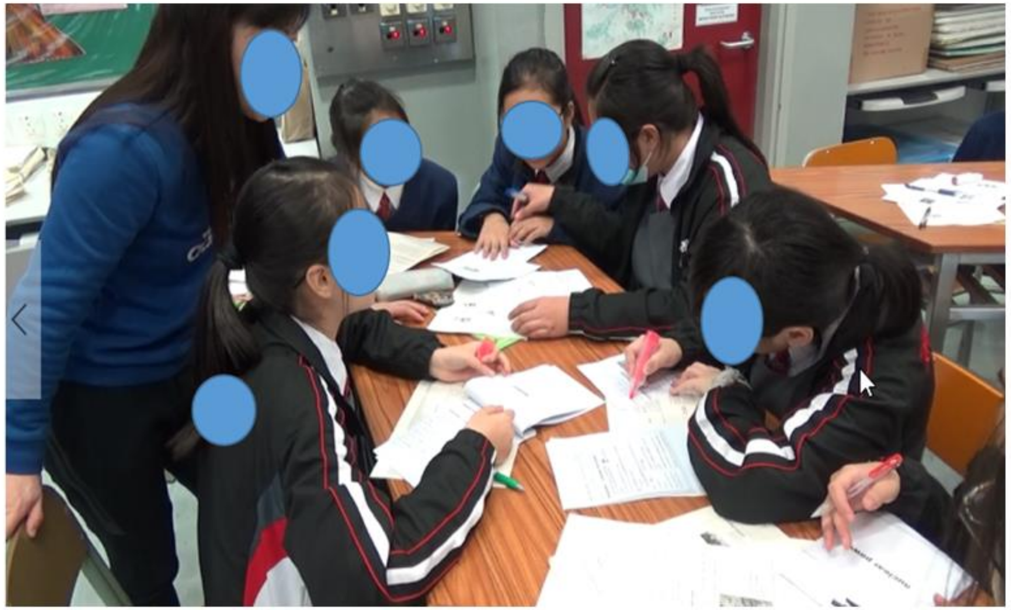
Complicated concepts are constructed by simple concepts which are connected logically according to the interrelationship between each other. The **'Concept + Language Mapping' Approach** visualises the interrelatedness between the concepts (thematic patterns).

R: *Now can you make your own C+L maps?*

S1: *I will* ***put all the key points on paper slips****, and then* ***stick them on my notebook****. And* ***the maps will connect all the key points together****.*

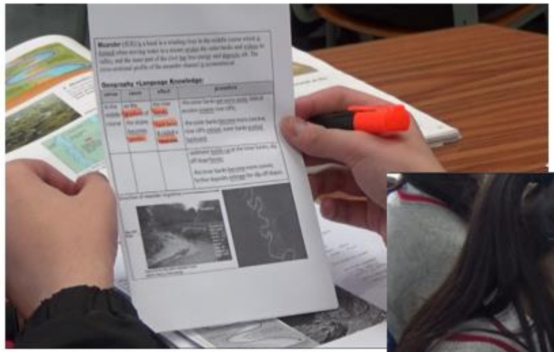
The **'Concept + Language Mapping' Approach** motivated students to do self-directed learning

Teaching and learning activities with CLM scaffolding---‘C + L’ Cards and ‘C + L’ Maps： Collaborative Learning

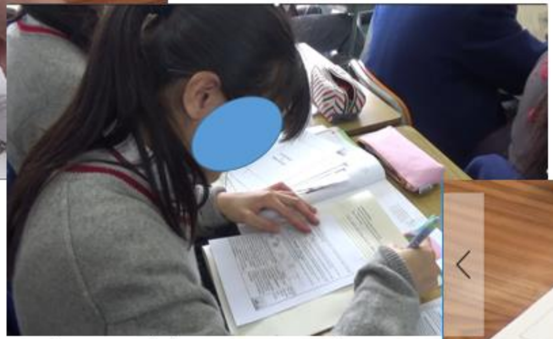


Discussing and learning with ‘C+L’ cards: Preparing for a debate activity

Teaching and learning activities with CLM scaffolding--‘C + L’ Cards and ‘C + L’ Maps: Self-directed Learning

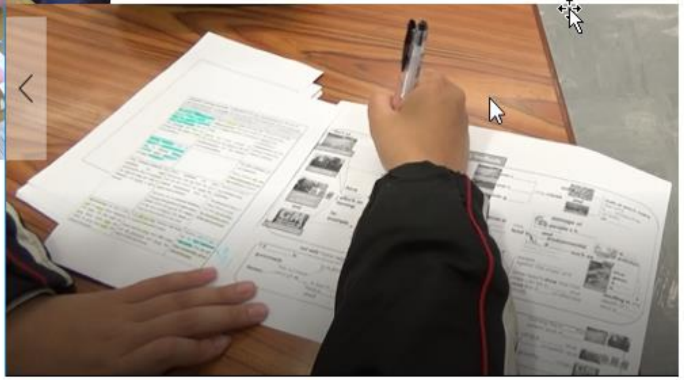


Highlighting notes on ‘C+L’ cards while listening to the lesson



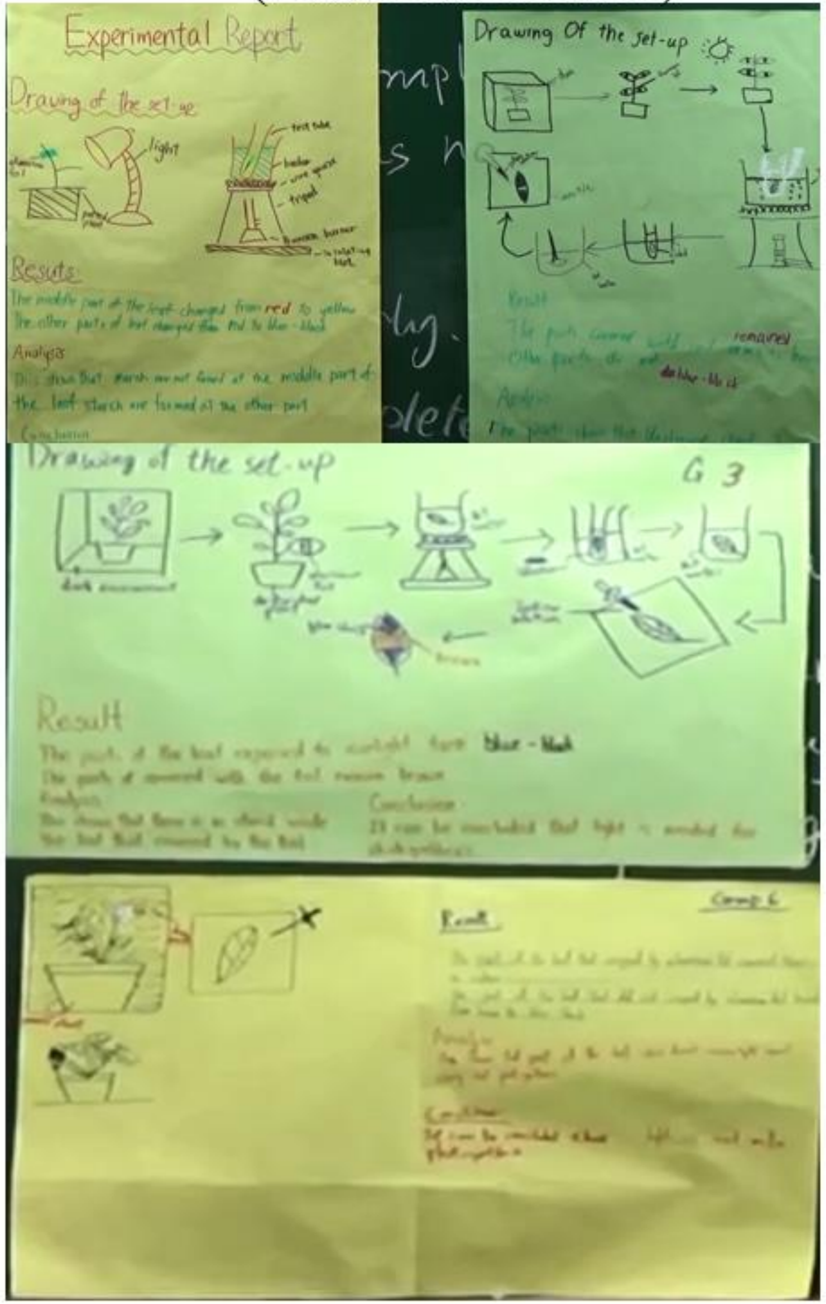
Finishing worksheet exercises by referring to ‘C+L’ cards

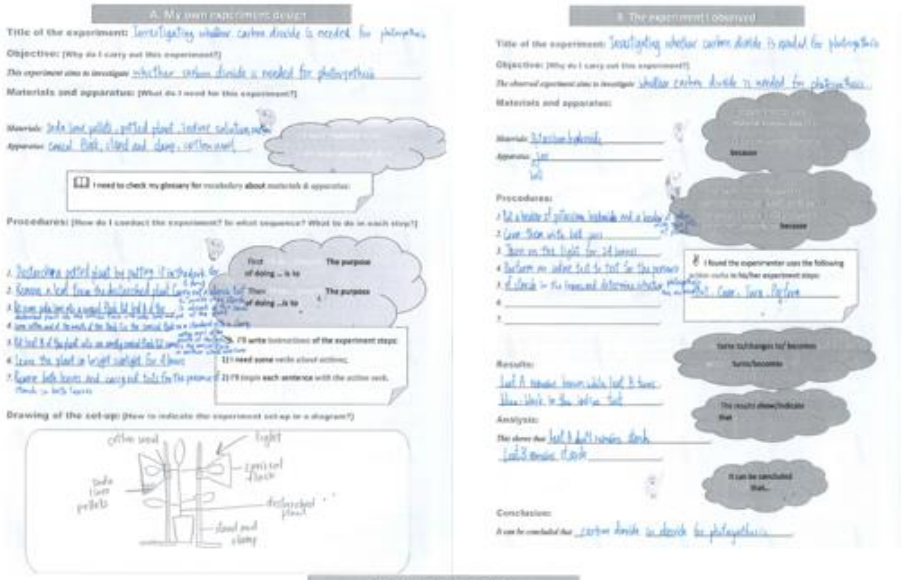
Completing ‘C+L’ Map by referring to ‘C+L’ cards



Group experiment design

(Joint construction)

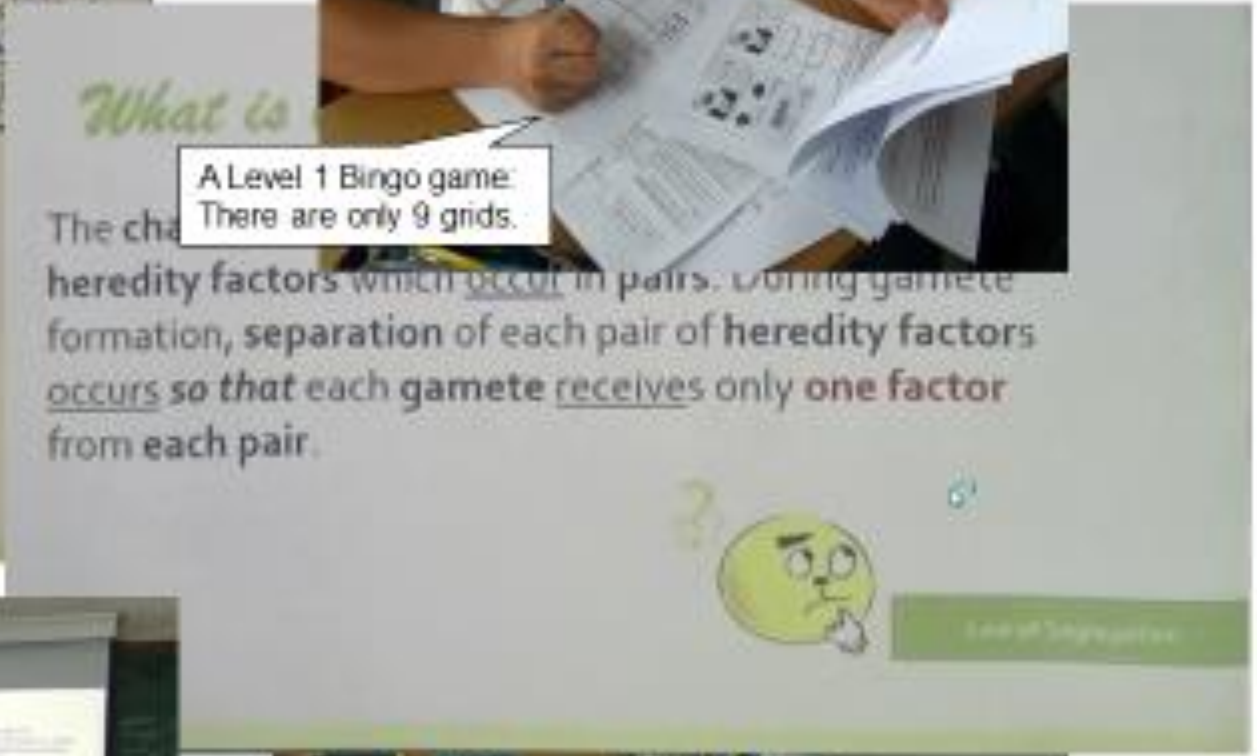




Experimental Reports

(individual construction)

Bingo Game with “C+L Cards”

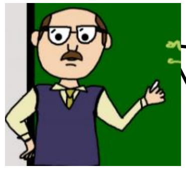


Finding 4

The importance of content and language **integration**

The thematic-pattern-based CLM approach helped the teacher to **raise** students' **awareness** of both academic content literacy and academic language literacy.

The thematic-pattern-based CLM approach **takes effect** only when the teacher **integrates** flexibly and appropriately the teaching and learning of both **content and language** during the CLIL practices.



*Soak means "to **immerse** something **into liquid** to clean it or make it softer*

Mr X: Okay. **'Soak' means you dip something completely under water**. Is it okay? **Or under a liquid**. So that is 'soak'. Highlight that. That is a new word that you, you may want to learn. Is that okay? **Instead of always saying 'put, put, put', you can say 'soak'**.

S1: Mr X. [raising hand] Can we **soak the… soak the leaves to the soda… soda…lime?**

Mr X: Under water or liquid. [smiling] Good question. What do you think? Soda lime, soda lime. **Is soda lime liquid or solid?**

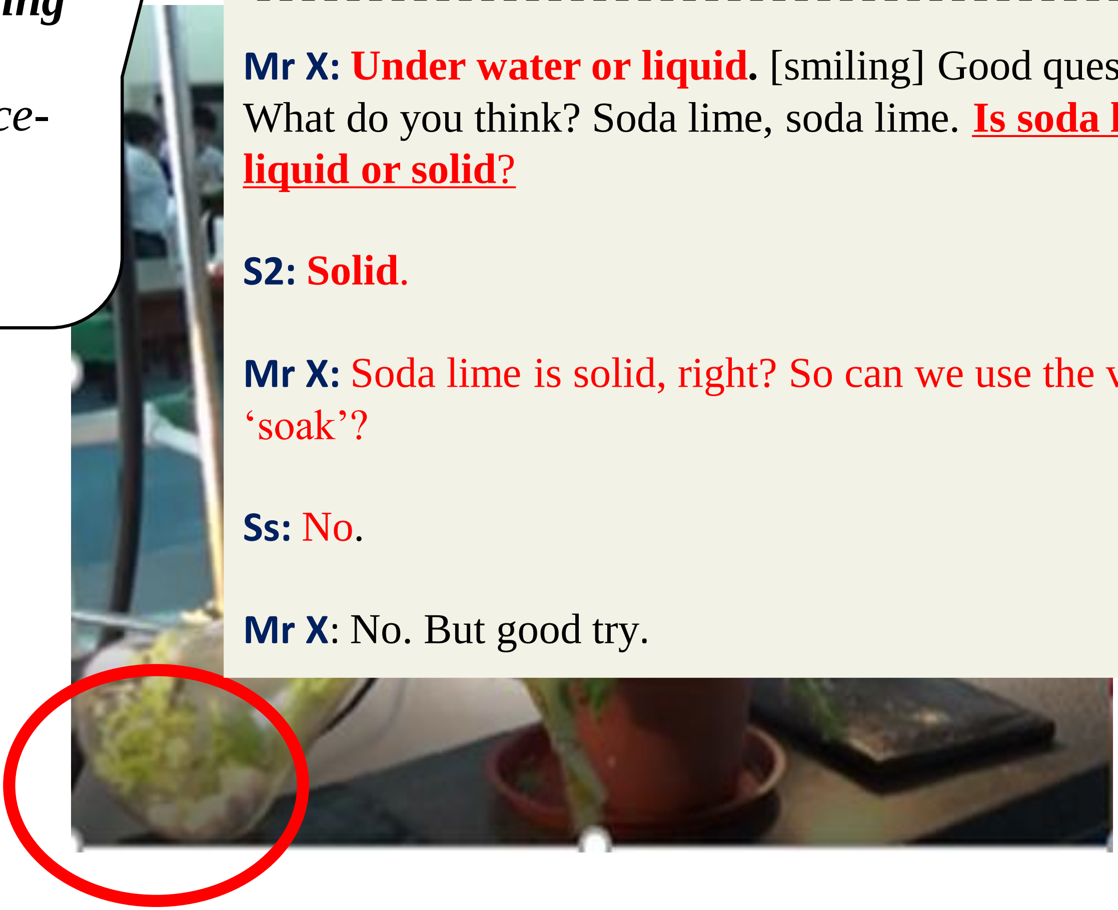
S2: Solid.

Mr X: Soda lime is solid, right? So can we use the verb 'soak'?

Ss: No.

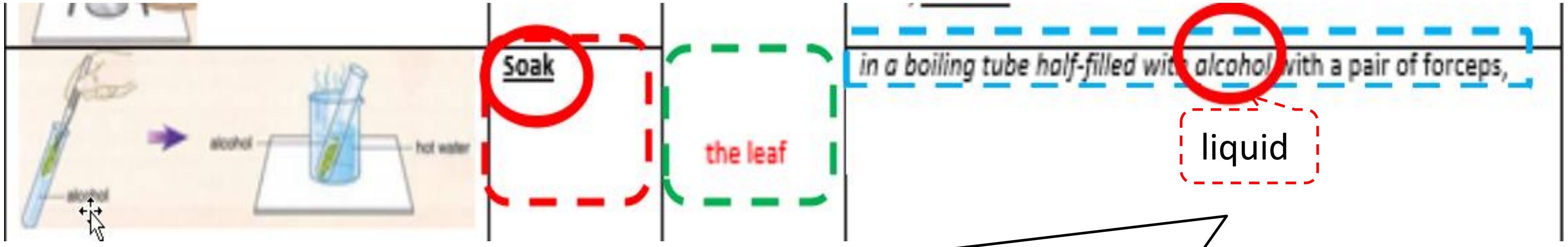
Mr X: No. But good try.

*Since in the previous experiment we "soak the leaves in **the boiling tube half-filled with alcohol**" (sample sentence in the sentence-making table), now can we say "soak the leaves in **the boiling tube with soda lime**?"*



Soda lime is a **solid** mixture of sodium and calcium hydroxides used to absorb carbon dioxide

Integrating the learning of **academic content knolwedge** and **academic language knowledge**

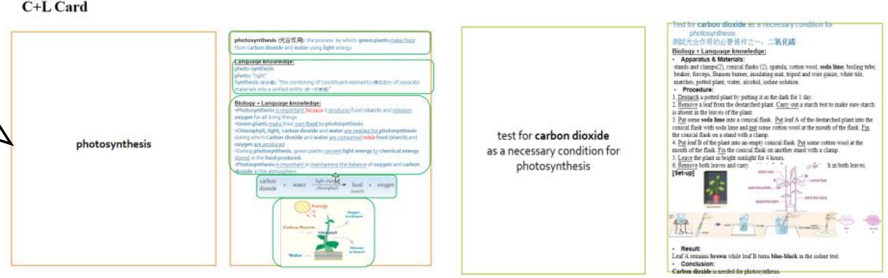


The **thematic pattern (***“Soak” , “the leaf” , “into a boiling tube half-filled with alcohol”***)** PROCESS/TARGET/CIRCUMSTANCE is highlighted in the sentence-making table. The special feature of the CIRCUMSTANCE of the thematic pattern requires a “liquid” not a “solid”.

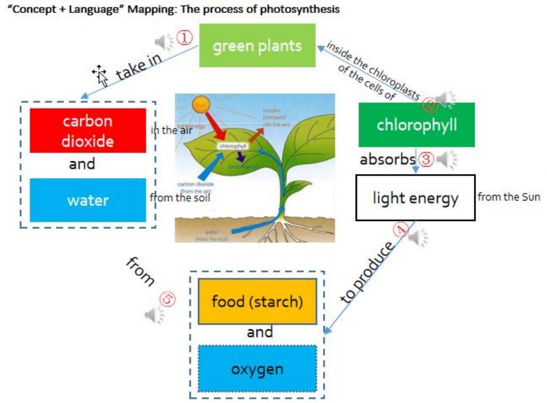
Learning by rote-memorization or C+L mapping?

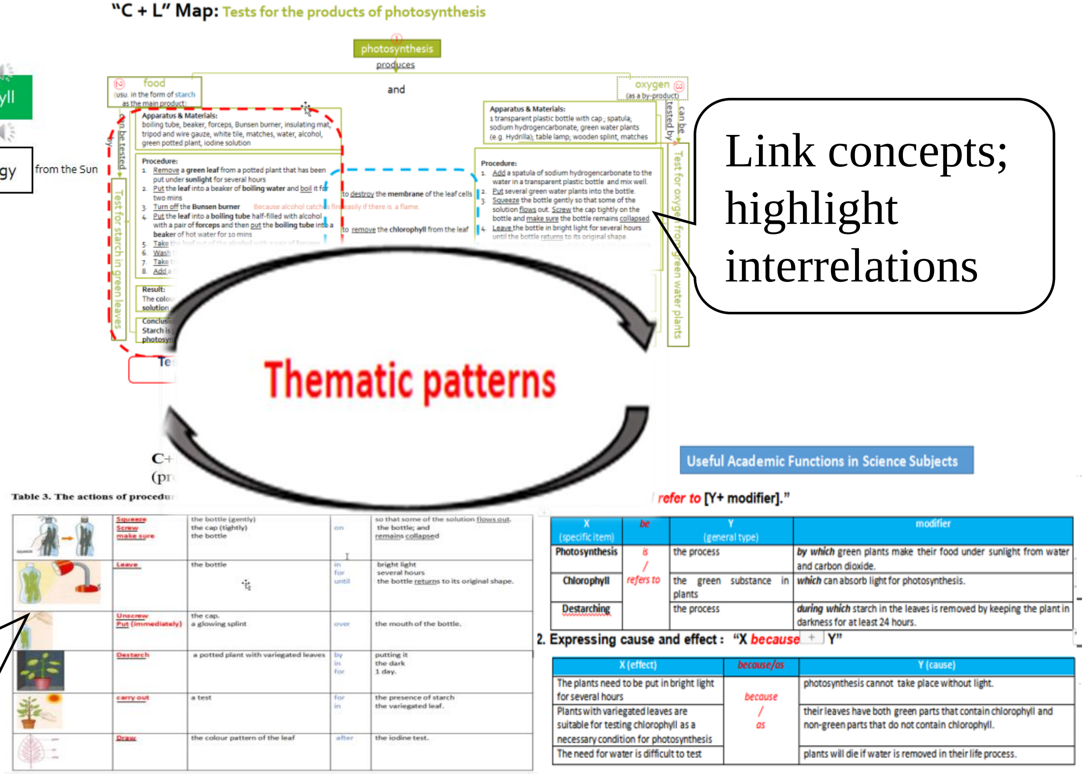
I tend to **rote-memorize** everything because **I cannot understand the meaning of the lessons,** therefore I cannot **re-associate (重整) the different concepts and knowledge points**

The CLM materials offered us a **meaningful learning strategy** and **scaffolding** which enabled us to learn the science concepts in <u>meaningful and logical and interrelated </u>way, hence it enhances our **awareness** in both academic language and academic content knowledge



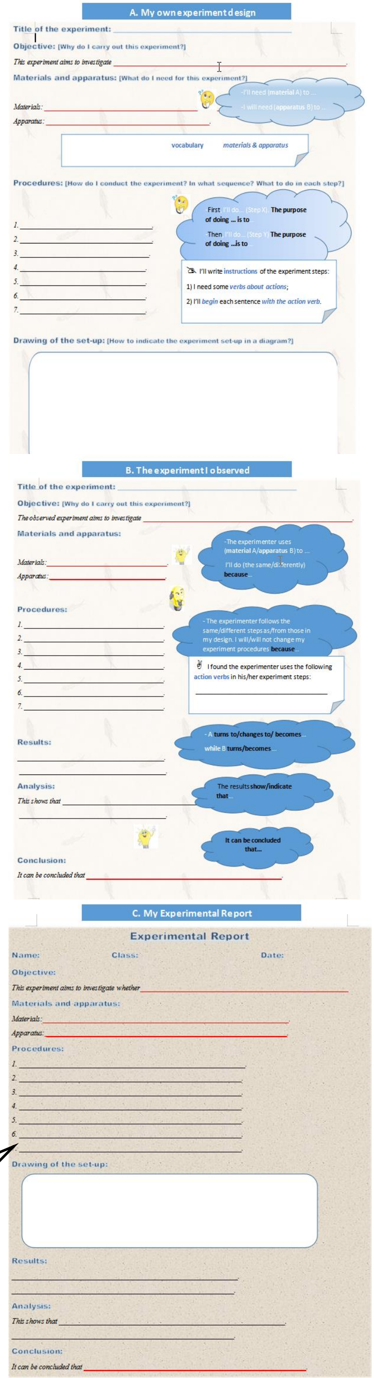
Summarize critical attributes of the concepts and clarify key concepts





Link concepts; highlight interrelations

Build up patterns of rhetorical/academic functions; highlight logical relations



Serve not only as a writing guide (genre structure, sentence pattern, grammar, vocabulary)but also a road map for exploring science via experiments (i.e. a storyline that guides the narration of the science story)

Integrating Content and Language in EMI Education

<u>Under the CLM Approach, content cannot be separated from language</u>

•The talking, reading, writing, representing and doing in content sujects cannot be implemented without the use of language in networks of thematic patterns and semantic relationships.

•The teaching of language becomes meaningless if it is not based on the content knowledge which it conveys.

Teacher education
about "thematic-pattern-based" CLM pedagogy

- CLIL teachers need to **go beyond** the **mechanical** and **dichotomous belief** that **CLIL** means **simple addition of "Content" and "Language"**.

- An indepth **reflection on** the "thematic-pattern-based" CLM approach and its pedagogy may give teachers an implication of **the true meaning of "integration"** in CLIL.

Limitations

- A quasi-experimental design

  -only one intervention class and one control class for each subject and grade

  -appromately 30 students in each cohort
- The limit of class number and class size may affect the quantitative result
- Short intervention (only tried out 3 - 8 lessons)
- The same teacher teaching both the control class and intervention class (e.g. in S1, S2 Junior Geography, S2 Integrated Science and S3 Biology)
- Delayed post-test in S2 Integrated Science

Implications for future research

- Future research on the thematic-patterns-based CLM approach may adopt a **longitudinal** research design.

- Intervention may be tried out in **other subjects with MOIs other than English**.

- Data collection may also **include students' design and elaboration** on their own CLM materials, e.g. how students express their understanding of the thematic patterns through their own C+L cards and maps.

- Data analysis may focus on **the effects of teacher's questioning and interactive/dialogic communication**s (Mortimer & Scott, 2003) on students' content and language development.

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