Please scan QR code or proceed via mobile browser to https://www.menti.com/691f2a0f
Use of Diagnostic Tools and Intervention Strategies for Language Issues in Science Writing

Peirce Secondary School Science Department
Flow of Presentation

1. Background
2. Language Issues
    a) Diagnosis
    b) Intervention
3. Challenges and Future Directions
4. References
5. Acknowledgements
Background

Scientifically Incorrect Response

Misconception (content knowledge)

Misrepresentation (knowledge of and about language)

Text-level

Sentence-level

(Seah, 2013)
State two ways in which a red blood cell differs from a typical animal cell.

(i) They do not have nuclei.
(ii) They are biconcave shaped.

Student describes red blood cells instead of comparing it to the typical animal cells.
# Outline of Intervention Lesson

## Lesson preparation
- Teacher groups students based on ability.

## Lesson enactment
- Students attempt a specific question in their ability groups.

## Lesson enactment
- Teacher identifies question type and unpacks question demands.

## Assessment and feedback
- Students attempt peer-marking.

- **Considering learner’s profile**
- **Setting meaningful assignments**
- **Providing clear explanation**
- **Supporting self-directed learning**
3. A student sets up three flasks as shown in Fig. 3.

![Diagram of plant and water in flasks]

She weighs each set of apparatus at the start of the experiment and again after 24 hours. During this time the three sets of apparatus are kept at the same temperature and humidity.

(b) The plants in apparatus A and B both lose water by transpiration from the leaves. Describe how water in the flask travels to the leaves and is lost by transpiration.
Providing Clear Explanations

Common question types:

- cause-effect
- comparison
- structure-function
- data-based
- experiment-based
Providing Clear Explanations

Unpacking the **demands of the question**

E.g. 1: **cause-effect** question
- biological process
- purpose or cause
- effect or significance
- location or example
The water has a higher water potential than the plant, hence causing water to enter the plant via osmosis down a water potential gradient, causing the water to move from cell to cell via osmosis.

**Question type:** Cause-effect of process  
**Command word:** Describe  
**Demands:**  
- refer to biological parts(location)  
- identify process  
- cause  
- effect
The water has a higher water potential than the plant, hence causing water to enter the plant via osmosis down a water potential gradient, causing the water to move from cell to cell via osmosis.

Question: The plants in apparatus A and B both lose water by transpiration from the leaves. Describe how water in the flask travels to the leaves and is lost by transpiration from the leaves.

- reference to biological parts: not correctly identified
- identify process: osmosis is correctly identified
- cause: difference in water potential clearly identified
- effect: not clear
Providing Clear Explanations

Unpacking the demands of the question

E.g. 2: **data-based** question
- quote values
- describe trends
- biological process
- mechanism
Providing Clear Explanations

- E.g. of **data-based** question

The figure below shows the glucose concentration in the blood before and after a meal containing carbohydrates is eaten.
a) Use the information in the figure to explain how the concentration of glucose changes after a meal is eaten.

The glucose concentration in the blood was constant until a meal was eaten. This resulted in a rapid increase of the glucose concentration in the blood, which led to the steep graph. However, after insulin was produced, the glucose concentration in the blood decreases, resulting in the graph declining gradually for a period of time before becoming constant again.
Qn: Explain, using the term ‘water potential’, what has happened to cell M.

When plant cell M is placed in concentrated sugar solution, the cell M will have a higher water potential compared to the sugar solution. Via osmosis, water moves to outside the cell. Water moves from a region of higher water potential to a region that is lower water potential. The cell do not lose its shape due to the cell wall. The cell membrane an vacuole, decreased in size due to water leaving the cell. The cell becomes flaccid and plasmolysed.
Diagnosis and Intervention

- **Diagnosis:**
  - **text**
  - **sentence**

- **RASA template**
  - question text-types

- **Intervention:**
  - unpack language demands of questions
  - increase student language awareness

时间轴

- **level**
  - text
  - sentence
adrenaline is released by adrenal glands

enzymes start dying [become denatured]

this causes the sweat glands to be active

thickening of [the walls of] the arteries
**Diagnostic Tool: RASA**

- **Relevance**: Missing contextual information
- **Appropriateness**: Use of everyday rather than scientific words
- **Specificity**: Lack of specificity in references used
- **Accuracy**: Lack or inaccurate use of verbs or nouns
Activity One

Please scan QR code or proceed via mobile browser to
https://www.menti.com/691f2a0f
Outline of Intervention Lesson

**Introduction**
Review of ‘Highlighter Marking’

**Teaching**
Introduce RASA.

**Development**
Students rework answers.

**Assessment for Learning**
Fresh set of questions will be given.

**Peer Feedback**
Peer marking is done using RASA.
Teaching: Introduce RASA

Relevance
Missing contextual information

Appropriate-ness
Use of everyday rather than scientific words

Specificity
Lack of specificity in references used

Accuracy
Lack or inaccurate use of verbs or nouns
Teaching: Introduce **RASA**
[Model Thinking Aloud]


The ovaries carry and store the unfertilised **eggs** which has not matured. Every month an **egg** is matured and it moves to the uterus, through the oviducts, the finger like projections, sweep the egg towards the uterus. In the uterus the lining is thickened with **blood**, so that it can be prepared for a baby. The egg is fertilised with by a sperm in the uterus and the egg attaches itself to the walls of the uterus. The blood in the lining provides the **embryo** with the nutrients it needs. The uterus also holds the **unborn** it is ready to be born.

- **inaccurate**
- **non-specific**
- **missing relevant details/key words**
- **inappropriate**
- **egyote**
# Outline of Intervention Lesson

## Introduction
- Review of ‘Highlighter Marking’

## Teaching
- Introduce RASA.
  - Providing Clear Explanation

## Development
- Students rework answers.
  - Providing Clear Explanation

## Assessment for Learning
- Fresh set of questions will be given.
  - Empowering Learners

## Peer Feedback
- Peer marking is done using RASA.
  - Checking for Understanding & Providing Feedback
Artefact One
- Shows student annotations and suggestions
Student response

<table>
<thead>
<tr>
<th>Topic:</th>
<th>Transport in Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keywords (or phrases) I think would be needed:</td>
<td>loss of water by evaporation, transpiration</td>
</tr>
<tr>
<td>My Answer (partial):</td>
<td>Another way is to decrease the light intensity as the higher light intensity will increase the size of stomata to open wider causing more water loss.</td>
</tr>
<tr>
<td>Peer Marker’s response</td>
<td></td>
</tr>
<tr>
<td>Relevance</td>
<td>Appropriateness</td>
</tr>
<tr>
<td>Pls tick (✓)</td>
<td></td>
</tr>
<tr>
<td>Reason(s)</td>
<td>Wrong word choices (specificity) and missing linking words (accuracy)</td>
</tr>
</tbody>
</table>

Artefact One
- Identification of relevant sentence-level mistakes
- Suggestion of better keywords and masked concepts
Findings
(from subsequent preliminary examinations)

(b) Explain, using the term **water potential**, what has happened to cell M. When cell M is placed in a concentrated sugar solution, the water molecules will move from a higher water potential to a lower water potential through the partially permeable membrane. Thus, sugar concentration will move into the plant cell, causing cell M to lose its shape and expand. [3]
Question: Explain, using the term water potential, what has happened to cell M.

Response:
When cell M is placed in a concentrated sugar solution, the water molecules move from a higher water potential to a lower water potential through the partially permeable membrane. Thus sugar concentration moves into the plant cell, causing cell M to lose its shape and expand.

[Inaccurate understanding: non-specific referents; misconception]
Activity Two

Please scan QR code or proceed via mobile browser to https://www.menti.com/691f2a0f
What did you learn from all the lessons?

- Answering technique: 32%
- Accuracy: 16%
- Sentence construction: 14%
- Question analysis: 11%
- Data-based question: 11%
- Specificity: 8%
- NA: 8%
Challenges

Teacher

**Optimisation**

- Teachers must allocate an appropriate amount of time for the linguistic dimension of science writing.

Student

**Inertia**

- Students could not see the relevance of language issues initially.
Future Directions

- Pre-emptive measures
- Question text types
- Unpack language demands of questions
- RASA template
- Increase student language awareness

Pre-emptive measures

Lesson planning

Diagnosis

Intervention

Time
Acknowledgements

• Dr Seah Lay Hoon (NIE)
• Mrs Betty Chow (Principal, PSS)
• Mrs Esther Chee (Vice-principal, PSS)
• Mrs Ng (Vice-principal, PSS)
• Ms Annie Tan (HOD/Science, PSS)
• Mrs Khet (SSD, PSS)
References


Seah, L. H. (2018). *Student challenges with these language components* [PowerPoint slides].
Thank you

Question and Answer