

# **One size might not fit all: Lessons from the validation of a science communication module**

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# Background information of the module

## Centre for English Language Communication (CELC)

- Communication modules for undergraduates of various faculties at NUS

## Faculty of Science

<b>Rationale</b>	Science students need to communicate <b>beyond lab reports</b> and conversations among their peers and with their lecturers.
<b>Objective</b>	To develop communication skills in disseminating <b>scientific developments</b> to <b>non-specialist</b> readers as well as scientists beyond their immediate fields.

## SP1541 Exploring Science Communication through Popular Science

## Statements of problems

- Lack of literatures on how to **'teach'** science students to communicate with the wider audience.
- Existing literatures focus more on the **principles** of science communication- deficit vs public participation models (Lewenstein, 2003).
- Others provide **generic guidelines** on how to write for the public (e.g. know your audience, avoid jargons), which are **not sufficient** to help novice writers to develop skills needed.
- The **language aspect** of science communication is largely ignored.

# Essential skills for science communication

Make technical content accessible  
by non-technical readers

Make science interesting  
Celebrate science

## Popular science news article

- aims to disseminate a **new discovery**, innovation or recent development in the scientific field
- is written based on a **research article** published in a peer-reviewed journal

# Development of syllabus and teaching materials

“Borrowed” literatures from other disciplines

Make technical content accessible	Make science appealing
<p><b>Popular discourse</b> (Calsamiglia &amp; van Dijk, 2004; Myers, 1991)</p>	<p><b>Media discourse</b> (Bednarek, 2006)</p>
<p>Changes in vocabulary, syntax and texts in the popularisation process</p>	<p>Language use to intensify the value and attract attention to the news</p>
<p><b>Explanatory strategies</b></p>	<p><b>Evaluative language</b></p>
<ul style="list-style-type: none"> <li>● Description &amp; definition</li> <li>● Exemplification</li> <li>● Metaphor and analogy</li> <li>● Non-technical terms</li> </ul>	<ul style="list-style-type: none"> <li>● Importance</li> <li>● Possibility</li> <li>● Expectedness</li> </ul>

## Objectives of the study

To validate this new syllabus by evaluating the effectiveness of the **explanatory strategies** and **evaluative language** taught in the module.

### Research questions:

- 1) To what extent does the use of **explanatory strategies** help make scientific concepts **comprehensible** by non-specialist readers.
- 2) To what extent does the use of **evaluative language** help make science news articles **appealing/newsworthy** to readers.

## Method

Mixed-method research design

### Data collection

#### Qualitative:

- **30 articles** (from students' assignments)
  - 20 “good” articles (receiving 80% and above)
  - 10 “satisfactory” and “weak” articles (receiving 63% and below)

#### Quantitative:

- **60 non-specialist readers** (NUS non-science major)
- Each reader rated **5 news articles** using a **Likert scale** for:
  - Level of comprehension (comprehensibility score).
  - Level of appeal (newsworthy value).
- **True/false questions** to validate the comprehensibility ratings

## Data analysis

### Quantitative:

- Calculated and ranked the articles based on the **comprehensibility** and **newsworthy scores**.
- Identified the correlations\* between the **comprehensibility** scores and:
  - a. the types of strategies used.
  - b. the frequency of strategy used.
- Identified the correlations\* between the **newsworthy** scores and:
  - a. the types of evaluative language used.
  - b. the frequency of evaluative language used.



## Data analysis

Qualitative:

- News articles that receive **significantly high** and **low** ratings for **comprehensibility** were be analysed for the use of **explanatory strategies**.
- News articles that receive **significantly high** and **low** ratings for **newsworthy value** were be analysed for the use of **evaluative language**.

## Results and Discussion

1) To what extent does the use of **explanatory strategies** help students in making scientific concepts **comprehensible** by non-specialist readers.

**Results on the correlation between comprehensibility score and:**

	Correlation value	p-value	Interpretation
Frequency of strategies used	0.07	0.69	Positive correlation (not significant)
Strategy types	0.32	0.07	Positive correlation (moderately significant)

## Results and Discussion

What the correlation results **mean**:

- Science news articles are **NOT** necessarily **easier to understand** when **more** explanatory strategies are used.
- But they can be **more comprehensible** if writers include **a variety of strategies**.

Instead of trying to include as many strategies as possible, students should be encouraged to be **strategic** and **selective** when using these strategies.

- **'Which'** strategy can best contribute the comprehensibility level of science news?

Table 1. Correlation between each **explanatory strategy** and the **comprehensibility score** using Pearson's product-moment correlation

Strategies	Correlation values	p-value	Interpretation
Exemplification	0.28	0.12	Positive correlation (moderately significant)
Non-technical term	0.22	0.91	Positive correlation (not significant)
Description/definition	0.09	0.62	Weak positive correlation (not significant)
Metaphor/analogy	-0.17	0.38	Negative correlation (not significant)

## Results from the qualitative analysis of top 10 articles (highest comprehensibility rating)

Everyday examples and illustrations were used to:

- make **unfamiliar concepts** more **relatable**.

LED light, **which is the light in your smartphone or computer screen, could kill bacteria in raw food products**". (S3)

- make **abstract concepts** more **concrete** and **tangible**.

**Concept:** Dependent events (Statistics)

If a house is burgled, it is very likely that another burglary will happen after a short period of time. This is because burglars will now know important information such as the location of the rooms, money, valuables, and exits. (S7)

## What makes ‘exemplification’ successful in making science comprehensible?

- Exemplification fills the knowledge gap.
- Prior knowledge & schema theory (An, 2013).
- Non-specialist readers lack the necessary background knowledge to comprehend science.
- Exemplification strategy provides:
  - a more relatable (everyday) example to an unfamiliar concept.
  - a concrete and specific illustration to an abstract concept.
- ‘Adjust the information to readers background knowledge’ (Hyland, 2010).

## What makes ‘metaphor and analogy’ unsuccessful in making science comprehensible?

- Metaphor explains an **unfamiliar** concept (scientific concept ) by **comparing** it to a more ‘**familiar/common**’ object.
- Semino, Deignan and Littlemore’s (2013) framework on factors that account for the success of metaphor and analogy.

### Results from the qualitative analysis:

- 1) Many of the objects that student writers used in this study were **not familiar or common** to lay readers .

Imagine a **plastic capsule that has spikes on it and contains a strand of string inside**. The spikes help the capsule to enter a machine through a hole and the plastic covering is melted for the string to be exposed to enter the machine. (S24)

# What makes ‘metaphor and analogy’ unsuccessful in making science comprehensible?

## Results from the qualitative analysis:

2) The **object** that is used to explain the complex scientific concept is **not comparable** to the actual scientific concept.

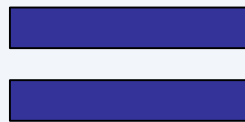
**Just as melted steel is poured into its mould to be shaped, the copper and CNS “mould” determines the shape of the product when carbon dioxide is “poured” into it. (S8)**



## What makes ‘metaphor and analogy’ unsuccessful in making science comprehensible?

- The common object is not comparable to the scientific concept.
- The “common” object is not familiar/common to readers.

**Unfamiliar  
(scientific)  
concept**



**Common  
object**

## Results and Discussion

2) To what extent does the use of **evaluative language** help students in making science news articles **interesting** to readers.

**Results on the correlation between newsworthy value and:**

	<b>Correlation value</b>	<b>p-value</b>	<b>Interpretation</b>
Frequency of evaluative language used	0.30	0.10	Positive correlation (moderately significant)
Evaluation areas (types)	0.18	0.34	Weak positive correlation (not significant)

## Results and Discussion

What the correlation results **mean**:

- Unlike the explanatory strategy, readers find science news articles **more newsworthy** when evaluative language is used **more frequently**.
- But, readers **may or may not** find science news articles **more newsworthy** when there is **a variety of** areas of evaluation.

**'Which'** evaluation area can best contribute the newsworthy value of science news?



Table 2. Correlation between each area of **evaluative language** and the **newsworthy value** using Pearson's product-moment correlation

Areas of evaluation	Correlation values	p-value	Interpretation
Possibility	0.41	0.02	Positive correlation (significant)
Expectedness	0.25	0.17	Positive correlation (moderately significant)
Importance	-0.21	0.25	Negative correlation (not significant)

## Results from the qualitative analysis: Possibility

- **Possibility** is often used to highlight **the application** of the new finding.
- Evaluative language in the area of ‘possibility’ introduces **the relevance** between the new finding and the readers’ lives.

The current clinical trial for a new drug, aducanumab, shows great **potential** as a treatment for Alzheimer’s disease. (S25)

If the experiment is successful, this **would** translate to people having the biological health of those 20 years younger. (S26)

Researchers have now discovered that our common blue light **might** actually help reduce food poisonings worldwide. (S3)

Their results **pave the way** to a greener future for our ailing planet. (S8)

## What makes ‘possibility’ successful in making science news more newsworthy?

- Popular science readers are the ‘outsider’ of science (Hyland, 2010).
- They may not ‘recognise’ the significance of the research results in the same way as experts in the field.
- Evaluative language in the area of possibility:
  - highlights the future benefits or potential application from the study.
  - establishes the relevance to readers.

# What makes ‘importance’ unsuccessful in making science news more newsworthy?

It is surprising that evaluative language in the area of ‘importance’ has a negative correlation with the newsworthy scores.

## Results from the qualitative analysis:

- 1) Student writers employed evaluative language in the area of ‘importance’ **without justifications**.

This has shown that the apple pomace is actually a strong contender for one of the most **important substance** in the world. (S4)

This is a **huge breakthrough** in the cyanobacterial circadian clock research community. It was impressive that a simple one-cell organism could change its body accurately according to day and night. (S22)

# What makes ‘importance’ unsuccessful in making science news more newsworthy?

## Results from this study:

2) The evaluative language in the area of importance is somewhat **subjective**

The notion of importance is expressed through the use of **adjectives** and the value of these terms can vary from person to person.

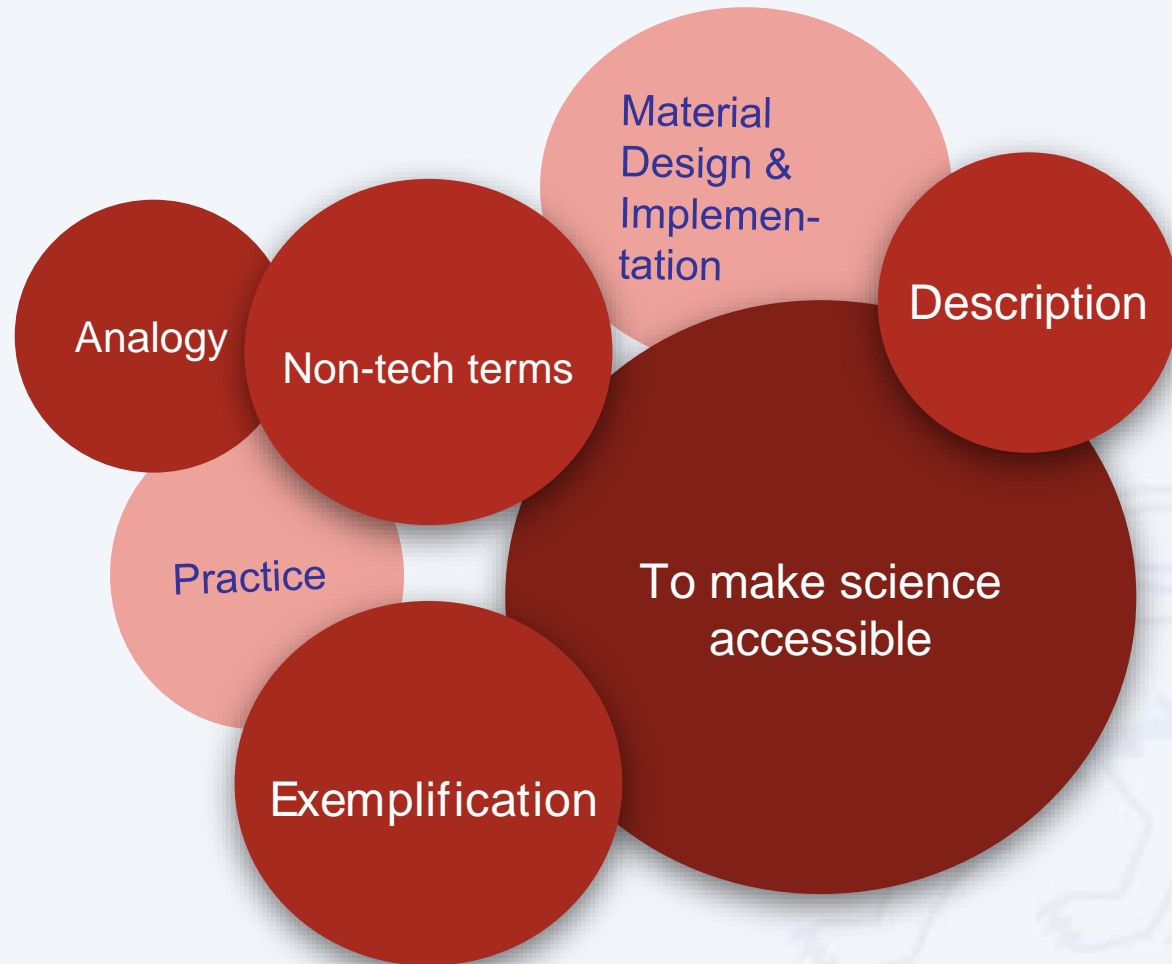
Their technique is **revolutionary** as it only required one single sided emitter to generate the sound. (S7)

This result holds **significant value** as Alzheimer patients have high levels of BACE1 in their brains. (S21)

What is **intriguing** is the dogs’ ability to integrate the “words” and “emotions” of human speech. (S12)



## Implications of the study



## Implications of the study



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# Questions & Answers

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