

# Developing academic reading skills of NNS graduate students in STEM

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## Background

The challenges faced by non-native speakers in STEM (Science, Technology, Engineering, Mathematics) in reading scientific research documents are well known. These include limited specialized vocabulary, lack of familiarity with the structure and organization of such documents and their level of detail and formality, limited knowledge of complex syntax, and few strategies and tactics to help them read more efficiently and effectively.

## Objectives

Identify specific user-friendly, self-access solutions that enable students to manage their reading load in a more efficient and effective manner. Participants will analyze the language, structure, organization, composition and construction of model research articles and one authentic journal article chosen from their major field to achieve a better understanding of the relationship of their various parts, and how the parts work to create a coherent whole.

## Materials

**Course materials** are adapted from authentic research articles. **Student-sourced materials** are short RAs from their area of study. These are vetted for suitability by the instructor, and must be approved for use on the course. Students apply the skills and strategies learned using course materials to their own specialist RA.

### Limited specialist vocabulary

Students compile a target vocabulary list using Lex Tutor and the AWL Highlighter and Gap fill webtools, and calculate the readability of their document based on their own lexical knowledge. They create quizzes of AWL and specialist vocabulary that they use throughout the course.

Function	Count	Percent
K1 Words (1-1000)	232	318 (83.94%)
K2 Words (1001-2000)	42	102 (3.53%)
AWL Words	90	128 (12.23%)

### Lack of familiarity with the structure and organization of RAs

Students learn the macro organization and identify the major moves in each section of their specialist RA before learning how paragraphs are structured and developed.

Activity 1: Name the section of a research paper that contains the elements listed. Work individually or in pairs as instructed by your lecturer.

Section	Move
Title	Identify the key terms
Author	Identify the key terms
Affiliation	Identify the key terms
Address	Identify the key terms
Email	Identify the key terms
Summary emphasizing the novelty, significance and substance of the research	Identify the key terms
Keywords	Identify the key terms
General introduction for those less familiar with field of research	Identify the key terms
Definitions of key terms	Identify the key terms
Aim of study (which fills the gap)	Identify the key terms
Hypothesis (or research question)	Identify the key terms
Selection of data	Identify the key terms
Classification of data	Identify the key terms
Description of survey instrument	Identify the key terms
Description of statistical analysis	Identify the key terms
Results showing key data	Identify the key terms
Results regarding gift authors	Identify the key terms
Results regarding ghost authors	Identify the key terms
Paraphrased approximation of key result	Identify the key terms
Comparison of results to previous research results	Identify the key terms
Implication of key result	Identify the key terms
List of academic papers cited in this article, arranged in order of appearance	Identify the key terms

### Limited familiarity with complex syntax and grammar

Students are introduced to SVOCA analysis, theme/rheme organization of paragraphs, the use of conjunctives and transitions, passive voice, nominalization, and the role of subject and finite verb.

Activity 7: Read the following excerpt from a research article. Note the way the theme of one sentence becomes the rheme of the following sentence.

Each of the three conditions (referred to hereafter as *control*, *ecologically relevant* and *ecologically non-relevant*) lasted for 41 days for 10 days, with an *interim control period* of 2 days between the conditions during which the animals were exposed to *no auditory stimulation other than that arising naturally* from their environment. Gorillas were first studied in the *control condition*, then the *ecologically non-relevant condition*, and finally the *ecologically relevant condition*. Both the *ecologically relevant* and *non-relevant conditions* were played using a CD player into both the gorillas' indoor exhibit and the indoor visitors' viewing area. The volume for both conditions was the same throughout.

Sentence	SVOCA structure
We sought the prevalence.	SVO.
We sought to determine the prevalence of articles.	SVO.
In this study, we sought to determine the prevalence of articles.	A.SVO.
In this study, we sought to determine the prevalence of articles with gift authors and with ghost authors.	A.SVO.
In this study, we sought to determine the prevalence of articles with gift authors and ghost authors in 6 peer-reviewed biomedical journals.	A.SVOA.
In this study, we sought to determine the prevalence of articles with gift authors and ghost authors in 6 peer-reviewed biomedical journals and we sought to assess something.	A.SVOA and SVO.
In this study, we sought to determine the prevalence of articles with gift authors and ghost authors in 6 peer-reviewed biomedical journals and to assess whether gift authorship and ghost authorship correlated with specific types of journals or articles.	A.SVOA and O.

Activity 2: Read the sentences and check if the SVOCA structure given for each sentence is correct. Tag the sentences using color.

#	Sentence	SVOCA structure
1	We sought the prevalence.	SVO.
2	We sought to determine the prevalence of articles.	SVO.
3	In this study, we sought to determine the prevalence of articles.	A.SVO.
4	In this study, we sought to determine the prevalence of articles with gift authors and with ghost authors.	A.SVO.
5	In this study, we sought to determine the prevalence of articles with gift authors and ghost authors in 6 peer-reviewed biomedical journals.	A.SVOA.
6	In this study, we sought to determine the prevalence of articles with gift authors and ghost authors in 6 peer-reviewed biomedical journals and we sought to assess something.	A.SVOA and SVO.
7	In this study, we sought to determine the prevalence of articles with gift authors and ghost authors in 6 peer-reviewed biomedical journals and to assess whether gift authorship and ghost authorship correlated with specific types of journals or articles.	A.SVOA and O.

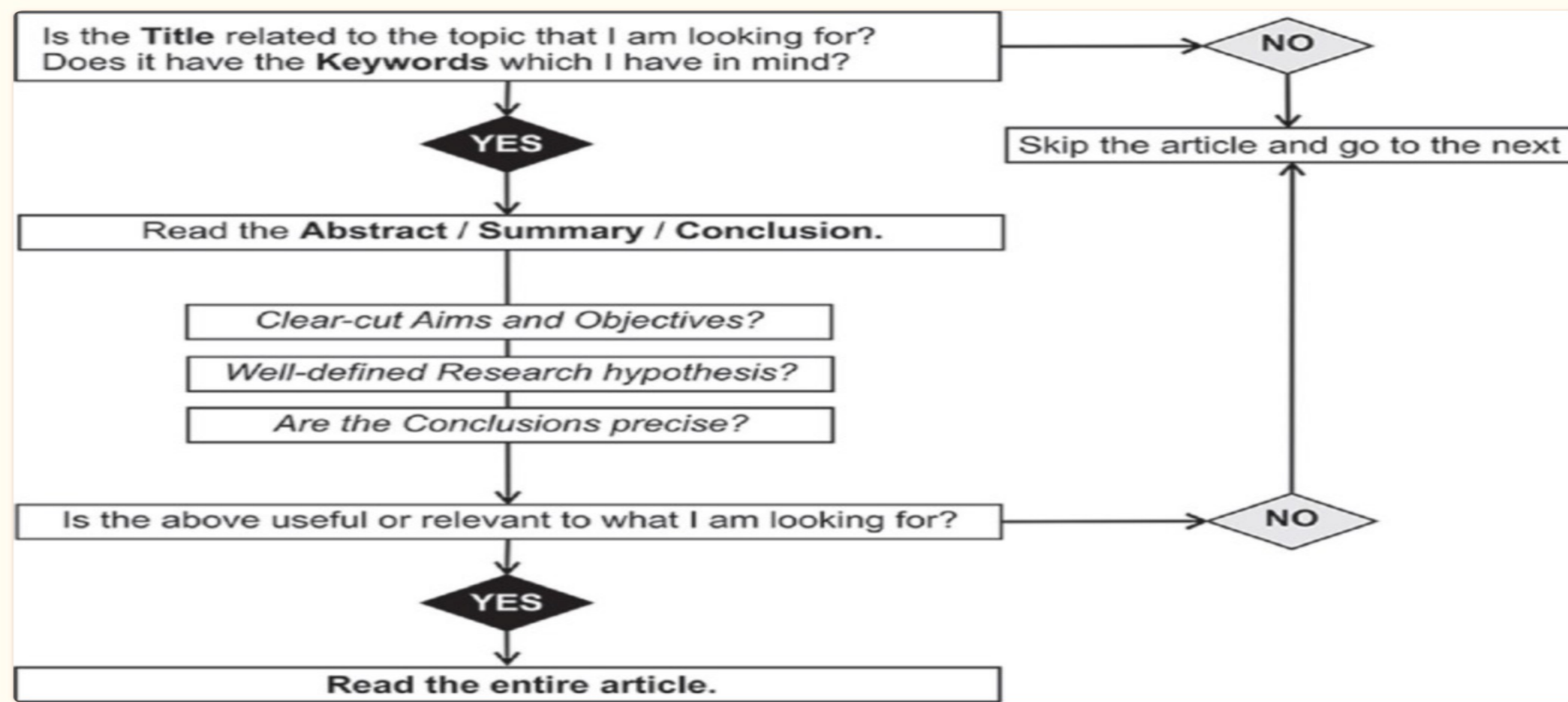
Activity 10: Insert a demonstrative pronoun or demonstrative adjective (this, that, these, those) to repackage the rheme as the theme in these sentences.

Engineering is a discipline that requires systematic analysis. ( ) means that engineers must be able to follow steps one by one.

To create a computer from scratch one must obtain a motherboard, a processor, some form of memory and a number of other relatively inexpensive parts. ( ) may amount to around JPY 100,000.

The devastating attacks on the World Trade Centre and the Pentagon sent a resounding message throughout the world that terrorists can target anyone anywhere. ( ) was further reinforced when the bombers struck in Bali.

## Outcomes



### Strategies and tactics to help students read more efficiently and effectively

- Pre-reading
  - Take note of the authors, their institutional affiliations and the publisher of the paper
  - Use keywords and title to determine relevance to your topic
  - List questions you want answered from your reading
  - Look at the visuals: tables, graphs, charts, images, diagrams, etc.
  - Know the content and purpose of each section:  
Intro: Why? Method: How? Results: What? Discussion: So what?
  - Know where key summaries typically appear
  - Know the funnel structure of scientific writing,
  - Understand ways the relationship of ideas is expressed in research writing
- On-task
  - Read the title, abstract and conclusions first
  - Find the RQ/purpose/aim at the end of the Intro; read the overview, if provided
  - Read systematically, but not in the order of the article
  - Use subheadings and the numbering system to understand organization in sections
  - Reflect on how this study relates to your own topic, or research question
  - Use the subject and finite verb of sentences to predict content
  - Answer Key Questions:
    - Why is this study being done?
    - What is the RQ, hypothesis or underlying thesis?
    - How was the research conducted?
    - What are the most significant findings of the study?
    - What are the weaknesses in their argument?
  - Highlight key info as you read, making notes in margins
- Post-task
  - Reread highlighted sections and confirm you have found the info you need
  - Revisit the questions you prepared before reading the RA
  - Verbally summarize each section of the RA in a paragraph
  - Draw a diagram of the Method used
  - Bullet point the main findings, and secondary / corollary findings
  - Paraphrase the conclusion in your own words

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