

LAB REPORT WRITING WORKSHOP

University of Rochester,
CHE 255 LAB

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COLLEGE WRITING PROGRAM

1.1 The Functions of the Lab Report

- To shed light on previously unexplained phenomena
- To prove or disprove others' work on a subject
- To improve on the efficiency or precision of others' work
- To show others how to duplicate your work for verifying results
- To ponder the meaning of your results within the context of others' work

1.2 Structure of the Lab Report

Executive Summary	An abbreviated form of the most important parts of the report. Usually the summary addresses: purpose of the experiment, given facts and data, assumptions, measured data, and results or conclusions. Details are not included.
Objective, Purpose, or Introduction	Discusses what the experiment hoped to accomplish. Typical aims include: (1) To shed light on previously unexplained phenomena, (2) To prove or disprove others' work on a subject, (3) To improve on the efficiency or precision of others' work, (4) To show others how to duplicate your work for verifying results, (5) To ponder the meaning of your results within the context of others' work.
Equipment and Apparatus	A list of Apparatus used in the experiments is frequently included in student laboratory reports. However, descriptions are usually not included. Common lab equipment, like stopwatches and scales, are typically excluded from the list.
Sample Calculations	Calculations clearly present the equations used with the data. Each section is labeled for easy identification. Results are underlined and indicated with an arrow drawn from the right margin. Explanations are not included in these calculations since the steps are self-explanatory. References are included for uncommon equations.
Laboratory Procedure or Methods	This section discusses the operation that is performed rather than listing the steps for performing the operation.
Data and Calculations	Data often includes sketches to identify the symbols that are used. The tables include column headings with units. The data is presented in the same sequence that it was collected and each section is clearly identified. An original data sheet may be included in the Appendix.
Discussion of Results	The discussion often begins with a brief summary of the results. All results are clearly identified. The discussion then compares the results from the different methods of determination. It also discusses the possible causes of irregularities with the anticipated results.
Conclusions	This section discusses the results with respect to the objectives stated at the beginning of the report. Sometimes, suggestions for further study or improvements may be suggested.
References	Lists sources of material for further research by the reader. The citations are alphanumeric and may include page numbers after the name of the publisher.

Science Writing - Logic

Readers will often read non-linearly

1. Read the executive summary, scan the references
2. Read the introduction and conclusion
3. Scan tables and/or figures
4. Read the discussion, methods and results last

Separable, specialized sections are essential!

Remember:

- Few people will closely read the entire lab report, but many will read the executive summary.

Problem:

- fitting all this content is not easy
- maybe only 200 or 250 words

- **Strategy:**
- adopt a systematic approach

1.3 Format of the Executive Summary

- a) Objectives/Purpose of the Lab
- b) Methods of the Lab
- c) Key Results of the Lab
- d) Conclusion

Objective/Purpose

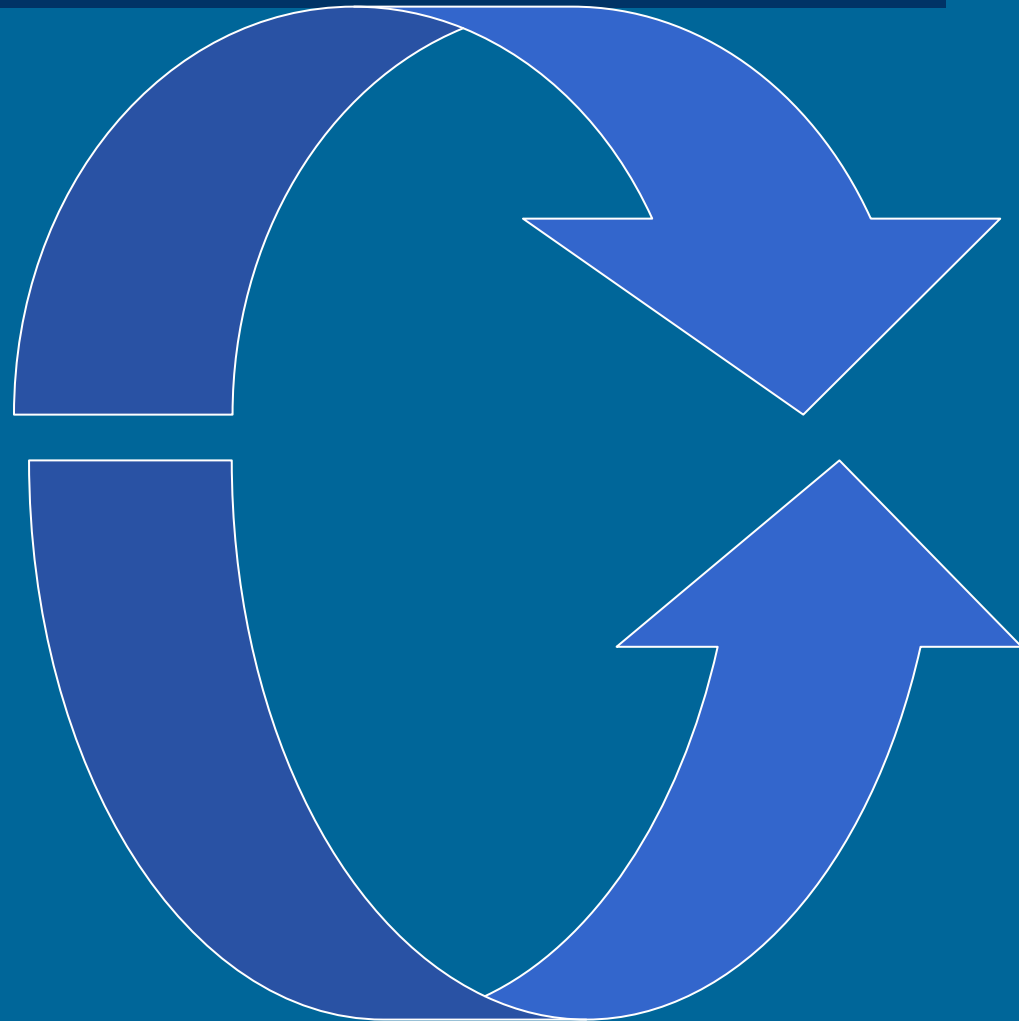
- statement about the importance or purpose of the study
- (perhaps brief comment on previous work in the field)
- the hypothesis
- benefits of the study should also be described

Establishing Your Niche

Enter into the conversation!!!

What's been written before about your topic? With what do you agree/disagree?

What's new about your own research and what does it add to the conversation?



Methods

- setting, study population, selection of subjects for the study and research design
- How were cases (patients or other sources of data) selected?
- What intervention was used?
- How were data collected?
- Over what period of time?
- If space allows, analytical techniques and statistical tests

Results

- number and type of observations
- summarize the key findings
- statistical test results

- Remember: precision is important

Conclusion

- be brief
- state whether the hypothesis was proven
- highlight the importance of the work
- generalization from the specific results to the wider world

1.3.1 Key Points

- abstract should be written separately, not as an extract from the main paper
- words should be chosen carefully
- imagine your reader is someone trying to retrieve information from a database
- words most likely to be searched should be present

1.4 A SAMPLE CHE 255 LAB REPORT SUMMARY

Vapor pressure of palladium from 1473 K to 1973 K

Abstract:

(1) Most of the available vapor pressure data for palladium has been taken below the fusion temperature. (2) In fact, only a few experimental studies exist on the vapor pressure of liquid palladium. In this current study, vapor pressures were measured from 1473 K to 1973 K (from well above and well below the melting point). (3) In addition, the range in temperature covered in the current study represents one of the largest continuous investigations of palladium vapor pressure to date. (4) The vapor pressure of palladium was studied using a Knudsen effusion cell and a commercial thermogravimetric balance. (5) Vapor pressures were measured using four Knudsen cells of different effusion areas with consistent results. (6) The standard enthalpy of sublimation calculated via a third-law analysis of the vapor pressure data is $(377.7 \pm 0.2) \text{ kJ}\cdot\text{mol}^{-1}$, in excellent agreement with the recommended value of $(377 \pm 5) \text{ kJ}\cdot\text{mol}^{-1}$ from the most recent review of available palladium vapor pressure data.

Task #1

- Work in small groups or in pairs. Read the following abstract and answer the questions that follow.

Vapor pressure of palladium from 1473 K to 1973 K

The vapor pressure of palladium was studied using a Knudsen effusion cell and a commercial thermogravimetric balance. Vapor pressures were measured using four Knudsen cells of different effusion areas with consistent results. Most of the available vapor pressure data for palladium has been taken below the fusion temperature, and only a few experimental studies exist on the vapor pressure of liquid palladium. In this current study, vapor pressures were measured from 1473 K to 1973 K (from well above and well below the melting point). In addition, the range in temperature covered in the current study represents one of the largest continuous investigations of palladium vapor pressure to date. The standard enthalpy of sublimation calculated via a third-law analysis of the vapor pressure data is $(377.7 \pm 0.2) \text{ kJ}\cdot\text{mol}^{-1}$, in excellent agreement with the recommended value of $(377 \pm 5) \text{ kJ}\cdot\text{mol}^{-1}$ from the most recent review of available palladium vapor pressure data.

3. LAB OBJECTIVE

/

PURPOSE

3.1 Lab Objective Outline

- | | |
|---------|---------------------------------------|
| Move 1 | Establishing a Territory |
| Step 1 | Claiming Centrality and/or |
| Step 2 | Making Topic Generalization(s) and/or |
| Step 3 | Reviewing Items of Previous Research |
| Move 2 | Establishing a Niche |
| Step 1A | Counter-claiming |
| Step 1B | Indicating a Gap |
| Step 1C | Question-raising |
| Step 1D | Continuing a Tradition |
| Move 3 | Occupying the Niche |
| Step 1A | Outlining Purposes and/or |
| Step 1B | Announcing Present Research |
| Step 2 | Announcing Principal Findings |

3.2 Task #2

Read the following introduction to a chemical engineering lab report. Try to label the three moves and then the various steps within each move. Remember not all steps may be used!

Task #2 - Answers

MOVE 1 1 - 5

STEP 1 1-3

STEP 2 4

STEP 3 5

MOVE 2 6

STEP 1C 6

MOVE 3 7 - 13

STEP 1B 7 - 11

STEP 2 12-13

3.3 The Language of Moves and Steps

A. Move 1 - Establishing a Territory

Step 1 - Claiming Centrality

- The increasing interest in ... has heightened the need for ...
- Of particular interest and complexity are ...
- Recently, there has been a spate of interest in how to ...
- In recent years, applied researchers have become increasingly interested in ...
- The possibility ... has generated interest in ...
- Recently, there has been wide interest in ...
- The time development ... is a classic problem in fluid mechanics.
- The explication of the relationship between ... is a classic problem of ...
- The well-known ... phenomena ... has been favorite topics for analysis both in ...
- Knowledge of ... has a great importance for ...
- The study of ... has become an important aspect of ...
- The theory that ... has led to the hope that ...
- The effect of ... has been studied extensively in recent years.
- Many investigators have recently turned to ...
- The relationship between ... has been studied by many authors.
- A central issue in ... is the validity of ...

B. Move 1 - Establishing a Territory; Step 3 - Reviewing Items of Previous Research

	Integral		Non-Integral	
1a	Brie (1988) showed that the moon is made of cheese.	Na	Previous research has shown that the moon is made of cheese (Brie, 1988).	Reporting Verbs
1b	The moon's cheesy composition was established by Brie (1988).	Nb	It has been shown that the moon is made of cheese (Brie, 1988).	
1c	Brie's theory (1988) claims that the moon is made of cheese.	Nc	It has been established that the moon is made of cheese ¹⁻³ .	
1d	Brie's (1988) theory of lunar composition has general support.	Nd	The moon is probably made of cheese (Brie, 1988).	Non-Reporting Verbs
1e	According to Brie (1988), the moon is made of cheese.	Ne	The moon may be made of cheese ¹⁻³ .	
		Nf	The moon may be made of cheese (but cf. Rock, 1989).	

Move 2 - Establishing a Niche

- **Step 1 A**
(Counter-claim)

While **some** have argued that **our study suggests the opposite.**

While **previous studies suffer from ...** and are **limited to ...** our study may provide alternatives that **improve on the previous limitations.**
- **Step 1 B**
(Gap)

The **previous studies focused on** adults, ages 21-45, but **failed to consider** children, ages 8-16 ...

While many have researched this growing trend in the United States, **our study examines whether** a similar situation exists in South Korea.

Move 2 - Establishing a Niche

- Step 1 C (Question) However, it is not clear whether the use of ... can be modified for children, ages 8-16.
A question still remains whether these studies are applicable to other countries and cultures, such as South Korea.
- Step 1 D (Continuation) This study continues the research of Dr. A and applies the same methods to children, ages 8-16.
The previous research suggested the direction for this study in

Language for Creating a Niche:

a) Negative or Quasi-negative Quantifiers

no little none (of) few / very few neither ... nor

b) Lexical Negation

Verbs fail, lack, overlook

Adjectives inconclusive, complex, misleading,
elusive, scarce, limited, questionable

Nouns failure, limitation

Other without regard for

c) Negation in the Verb Phrase

not rarely ill

Language for Creating a Niche:

d) Questions

- Direct (e.g. How can this problem be solved?)
- Indirect (e.g. "A question remains whether ...")

e) Expressed Needs/ Desires/Interests

- The differences need to be analyzed ...
- It is desirable to perform test calculations ...
- It is of interest to compare ...

Move 3 - Occupying The Niche

Step 1 - Outlining Purposes or Announcing Present Research

- This paper reports on the results obtained ...
- The aim of the present paper is to give ...
- In this paper we give preliminary results of ...
- The main purpose of the experiment reported here was to ...
- This study was designed to evaluate ...
- The present work extends the use of the last model ...
- We now report the interaction of ...
- The purpose of this investigation is/was to ...

g) Contrastive Comment

- The research has tended to focus on ..., rather than ...
- They center mainly on ..., rather than on ...
- Studies most often contrast ..., rather than ...
- Researchers have focused primarily on ..., as opposed to ...
- Emphasis has been on ..., with scant attention given to ...
- Although considerable research has been done on ..., much less is known as to ...

Move 3 - Occupying The Niche

Step 1 - Outlining Purposes or Announcing Present Research

- This paper reports on the results obtained ...
- The aim of the present paper is to give ...
- In this paper we give preliminary results of ...
- The main purpose of the experiment reported here was to ...
- This study was designed to evaluate ...
- The present work extends the use of the last model ...
- We now report the interaction of ...
- The purpose of this investigation is/was to ...

One More Introduction

Distillation is one of the most common forms of industrial refinement. This process enables us to increase the concentrations of certain chemicals from their raw solutions. It is widely used in the petroleum industry as well as many other industries. Here we characterized the efficiency and heat loss of an experimental distillation column. All relative concentrations were evaluated using a gas chromatograph.

An ethanol-water mixture was purified through a five stage column under a reboiler power of 1200 to 1800 watts; it should be noted that the data from the high power points is susceptible to error as a result of inter-stage contamination. Our analysis encompassed both the Murphree efficiency from the column as well as heat losses. This characterization process would need to be re-performed if a different mixture needed to be purified.

4. RESULTS AND DATA COMMENTARIES

4.1 RESULTS AND DATA COMMENTARIES

- Provide sufficient background
- Introduce the table and locate it for the reader.
- Highlight the key results.
- Explain the significance and/or implications of those key results.
- Conclude with a strong or weak claim stating how these results support your thesis.
(Normally this part appears in the CONCLUSION section)

Look over Table 5, read the data commentary that follows, and then answer the questions.

1. Where does the data commentary actually start?
2. What are the purposes of sentences 1 and 2?
3. Which sentence contains the author's key point?
4. The author has chosen to comment only on e-mail attachments. Why? Do you think this is enough? If not, what else should be discussed?
5. E-mail attachments constitute 87% of the total. In sentence 4, this is expressed as "nearly 9 out of 10." What do you think about this and about the following alternatives?
 - about 90%
 - just under 90%
 - as much as 87% of all
 - nearly all

Structure of Data Commentary

Location + indicative summary - Linking *as*-clause + highlight

(3) Table 5, above, shows the most common sources of infection for U.S. businesses. (4) As can be seen from the first row, in a great majority of cases, the entry point of the virus infection can be detected, with e-mail attachments being responsible for nearly 9 out of 10 viruses. (5) This very high percentage is increasingly alarming, especially since with a certain amount of caution such infections are largely preventable. (6) In consequence, e-mail users should be wary of all attachments, even those from trusted colleagues or known senders. (7) In addition, all computers used for e-mail need to have a current version of a good antivirus program whose virus definitions are updated regularly. (8) While it may be possible to lessen the likelihood of downloading an infected file, businesses are still vulnerable to computer virus problems because of human error and the threat of new, quickly spreading viruses that cannot be identified by antivirus software.

- Implications

4.3 Location Elements and Summaries

Location Element

- a. Table 5 shows computer viruses for U.S. businesses.
- b. Table 2 provides fertilizer used.
- c. Figure 2 plots last five years.
- d. Figure 4.2 gives second experiment.

Summary

- the points of entry of
- details of the
- the two series for the
- the results of the

The passive voice can also be used.

Summary

- a. The most common modes of computer infection for U.S. businesses
- b. The details of the fertilizer used
- c. The two series for the last five years
- d. The results of the second experiment

Location Element

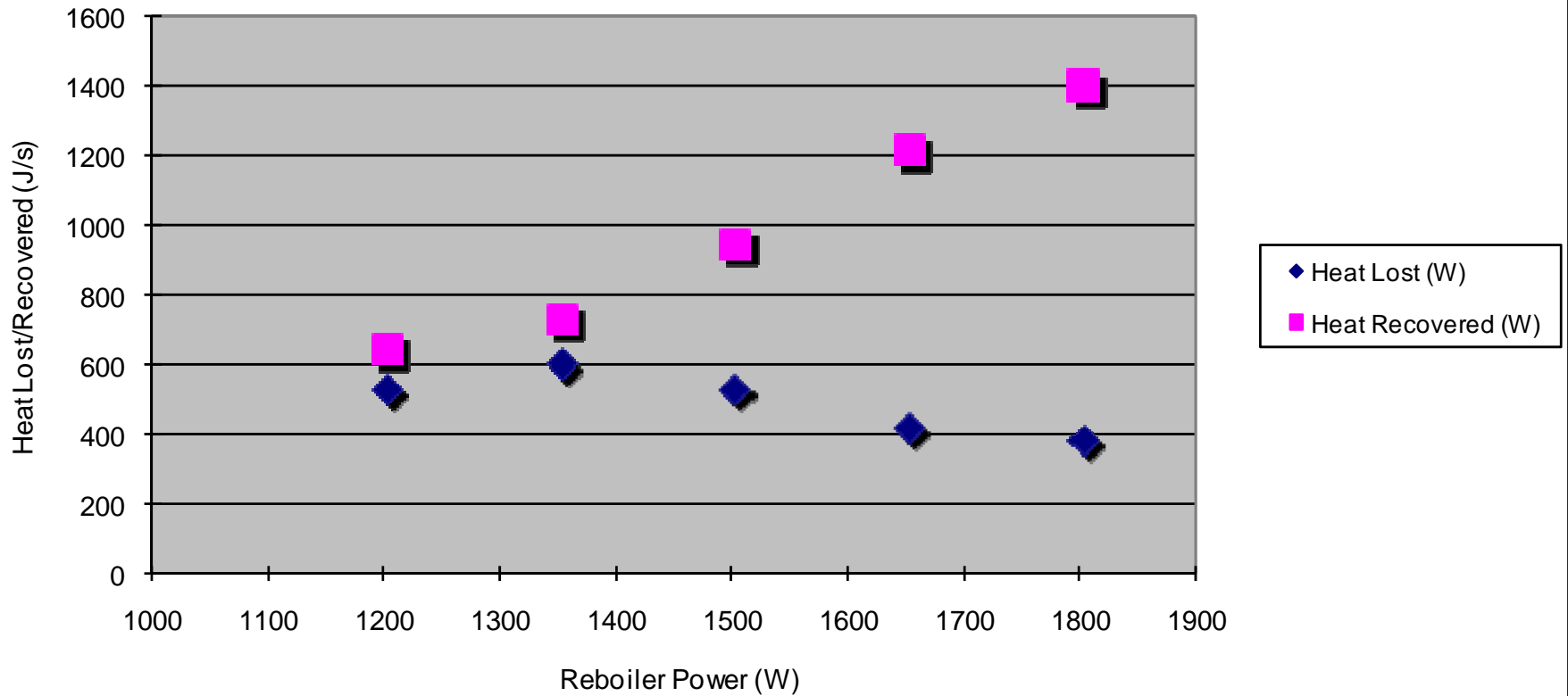
- are shown in Table 5.
- are provided in Table 2.
- are plotted in Figure 2.
- are given in Figure 4.2.

4.4 Data Commentary Task

Table 6 provides some data related to chemical engineering. Individually, consider what data you might highlight and what your discussion will contain. Then, write one data commentary and compare with the other members of your group. Don't forget to include a short background then a location + indicative summary at the beginning.

Write your own!

Calc I: Reboiler Power vs. Heat



5. LANGUAGE FOCUS: CONNECTING IDEAS

5.1 This + noun phrase

This device links the current sentence with the previous one putting “old” or “given” information before “new” information at the beginning of a sentence.

Consider the following statement:

The first experiment yielded significantly higher results than expected.

Which of the following do you prefer?

- *It* surprised our research team.
- *This* surprised our research team.
- *This yield* surprised our research team.
- *This unexpectedly high yield* surprised our research team.
- *This unexpectedly high yield from the first experiment* surprised our research team.

5.2 Connecting Words

	Subordinators(DC <> IC)	Sentence Connectors(→ IC) despite	Phrase Linkers (IC <>NP)
Addition		furthermore, plus, in addition, moreover	in addition to
Adversativity	although, even though,	despite the fact, however, nevertheless, in contrast, on the other hand, conversely	despite, in spite of, in contrast to, unlike
Cause and Effect	because, since, while, whereas	therefore, as a result, consequently, hence, thus*	because of, due to, as a result of, thus*
Clarification		in other words, that is, to explain further	
Illustration		for example, for instance, to illustrate	especially, particularly
Intensification		on the contrary, as a matter of fact, in fact	

5.3 Punctuation

There are several ways to link two ICs. Take for example the following two sentences:

I like chocolate. She likes vanilla.

- 1) I like chocolate; she likes vanilla. (IC ; IC)
- 2) I like chocolate, **but** she likes vanilla. (IC , **conjunction** IC)
- 3) **Whereas** I like chocolate, she likes vanilla. (DC, IC)
- 4) I like chocolate **whereas** she likes vanilla. (IC DC) ***note no comma**
- 5) I like chocolate; **however**, she likes vanilla. (IC ; connecting word, DC)

5.4 Academic Vocabulary

Discipline	Verbs and Frequency					
	1	2	3	4	5	6
Rank						
Biology	describe	find	report	show	suggest	observe
Physics	develop	report	study	find	expand	
Epidemiology	find	describe	suggest	report	examine	show
Nursing	show	report	demonstrate	observe	find	suggest
Education	find	suggest	note	report	demonstrate	provide

Thesaurus / Dictionary

Or

Shift + F7

MSWord

6. Summary

1. Executive Summary Differs from a Lab Report - Don't Copy and Paste!
2. Analyze Writings within the Genre; Break it Down into 4 Parts
3. Most Difficult is Locating the Lab Objective within the Larger Issue
4. Language Focus: Connecting Ideas
5. Academic Vocabulary

Resources

Baugh, S.L. (1997). *How to Write Term Papers and Reports, 2nd Edition*. Lincolnwood, IL: VGM Career Horizons.

Brazier H (1997) *Writing a Research Abstract: Structure, Style and Content*. Nursing Standard. 11, 48, 34-36.

Swales, John M. (1996) *Genre Analysis: English in Academic and Research Settings*. (Cambridge Applied Linguistics). Cambridge: Cambridge University Press.

Swales, John and Christine B. Feak, (2004) *Academic Writing for Graduate Students: Essential Tasks and Skills* (Second Edition). Ann Arbor: University of Michigan Press.

Swales, John M. and Christine B. Feak. (2000) *English in Today's Research World: A Writing Guide*. Ann Arbor: University of Michigan Press.

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