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Course : COMP6575 – Research Topics in Computer Science

Effective Period : December 2019

# The Introduction of Designing Research

## Session 06

# **Learning Outcomes**

At the end of this session, students will be able to:

- LO 1: Describe the basics of writing research paper and the research lifecycle

- LO 2: Select the research topic, literature and writing strategies used in the project

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# **Outline**

1. Structure and Organization
2. The Standard Structure of a Scientific Paper
3. Introduction
4. 3 Phases in Introduction by Swales
5. Common Pitfalls in Writing an Introduction
6. Method
7. Common Pitfalls in Writing a Method
8. Results and Discussion
9. Common pitfalls in Writing the Results and Discussion
10. Conclusions
11. Common Pitfalls in Writing the Conclusion
12. Abstract
13. Titles
14. Keywords

# Structure and Organization

# Structure and Organization

- Writing is inherently a creative process

- Many scientists do not think of themselves as qualified readers, finding the task of writing both intimidating and arduous

- There is a formula for how to structure and organize a scientific paper, so that the scientist/writer can focus on what they know best– the science – and worry less about the writing

# The Standard Structure of a Scientific Paper

- The vast majority of papers published in scientific journals today follow a fairly simple structure. With some variations, most papers use an "IMRaD" format:

  1. Introduction
  2. Method (experiment, theory, design, model)
  3. Results and Discussion
  4. Conclusions

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# Introduction

- In standard rhetoric, the introduction section should answer 2 questions: "What" and "So What?" what is paper about, and why should the reader care?

- An introduction should inform the reader as to what the paper is about and motivate the reader to continue reading

- A paper must meet 4 criteria before it is publishable in a scientific journal:

  1. The content of the paper must watch the scope of the journal

  2. The quality of the paper (method and execution of the research, as well as the writing) must be sufficiently high

  3. It must present novel results (with the exception of review papers)

  4. The results must be significant enough to be worth

# 3 Phases in Introduction by Swales

- Establish a territory

  What is the field of the work, why is this field important, what has already been done?

- Establish a niche

  Indicate a gap, raise a question, or challenge prior work in this territory

- Occupy that niche

  Outline the purpose and announce the present research optionally summarize the results

# Common pitfalls in Writing an Introduction

- Providing unnecessary background information Telling the reader what they already know or what they do not need to know

- Exaggerating the importance of the work, or failing to make clear what research questions this paper is trying to answer

# Method

- The method section (sometimes called the materials and method section) describes how the results were generated.

- It should be sufficiently detailed so that an independent researcher working in the same field could reproduce the results sufficiently to allow validation of the conclusions.

- A method is used here more broadly than an experimental method. The method can include the development of a theory, the establishment of a specific device design, or the development or description of a modeling tool to be used

- A good method section should not only describe what was done and how it was done, but it should justify the experimental design as well.

# Common Pitfalls in Writing a Method

- Abandonment of the goal of reproducibility
- Some researchers may not want their results to be questioned
- Others may want to hide necessary details for commercial reason
- Including results in the method section
- Extraneous details (unnecessary to enable reproducibility or judge validity)
- Treating the method as a chronological history of what happened

# Results and Discussion

- The results of a paper, if included as its own section, should be very short.

- It is simply a presentation of the results obtained corresponding to the methods described in this previous section, organized to make them accessible to the reader.

- Often these results are presented in tables and/or graphs

- The results that are usually combined with a discussion of them in the results and discussion section

- An important goal when presenting results is to clearly designate those results that have been previously published.

# Common pitfalls in writing the results and discussion

- Lack of organization
- Presenting results that are never discussed
- Presenting discussion that does not relate to any of the results
- Presenting results and discussion in chronological order rather than logical order
- Ignoring results that do not support the conclusions
- Drawing conclusions from results without sound logical arguments to back them up

# Conclusions

- The conclusions section provides a brief summary of the results and discussion, but it should be more than a summary

- The goal here are:
  - to provide the most general claims that can be supported by the evidence
  - In addition to that, the goal is to provide a future perspective on the work

- The conclusions section should allow for opportunistic reading. When writing this section, imagine a reader who reads the introduction, skims through the figures then jumps to the conclusion. The conclusions should concisely provide the key messages the author wishes to convey

# Common pitfalls in writing the conclusion

- Repeating the abstract
- Repeating background information from the introduction
- Introducing new evidence or new arguments not found in the results and discussion
- Repeating the arguments made in the result and discussion
- Failing to address all of the research questions set out in the introduction
- Conclusion should be more than just a summary

# Abstract and Title

# Abstract (1)

- Bad titles and poorly written abstracts are exceedingly common in the scientific and technical literature

- The purpose of the title and abstract is to get the right people to read your paper

- The title (followed by the abstract) is the first thing a reader sees and so it should be the last thing an author writes. The abstract should be written before the title.

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# Abstract (2)

- The most common mistake in writing an abstract is to not pay much attention to it
- The abstract should be a concise, stand-alone summary of the paper that covers the following topics
  - Background / motivation / context
  - Aim / Objectives(s) / problem statement
  - Approach / methods / procedures / materials
  - Results and
  - Conclusions / Implications

# Structured Abstracts

- In engineering and physical sciences a five-structure format is probably best :
    1. Background

       What issues led to this work? What is the environment that makes this work interesting or important?
    2. Aim

       What did you plan to achieve in this work? What gap is being filled?
    3. Approach

       How did you set about achieving your aims (e.g. experimental method, simulation approach, theoretical approach, combination of these, etc.), what did your actually do?
    4. Results

       What were the main results of the study (including numbers, if appropriate)?
    5. Conclusions

       What were your main conclusions? Why are the results important? Where will they lead?
- Each subsection should contain 1 to 2 sentences

# Titles

- Once the abstract is finished, it is time to write the title

- Unfortunately, it is against human nature to write the title last. Instead, the title is often the first thing written, at the top of that blank document that will soon become your manuscript.

- It is probably impossible to define a universal procedure for creating a good title – there is no equivalent "structure method" for writing a title.

- There are some basic guidelines, however that make use of the structured abstract to guide the creation of the title.

- In general, the title should reflect the aim and approach of the work

# Example

- Unlike the worlds of newspaper reporting and marketing press releases, the title of a scientific paper should describe the aim of the work, not the results. Thus a good title might be

**Impact of temperature and pressure on the compositional uniformity of sputter-deposited aluminum alloys**

- The following news-style title, on the other hand is not appropriate:

**Optimizing temperature and pressure improves sputter-deposited aluminum alloy films**

# Example

- Often it is important to mention approach used as well, though an experimental approach is generally assumed if it is not mentioned.
- If the study had been based on simulation (or some other approach), however, this would generally be included in the title:

**Impact of temperature and pressure on the simulated compositional uniformity of sputter-deposited aluminum alloys**

- The title should be as specific as possible while still describing the full range of the work.

## Impact of temperature and pressure on the simulated compositional uniformity of sputter-deposited aluminum alloys

- For example, if only one aluminum alloy was studied, that specific alloy should be mentioned in the title.

- If only aluminum alloys are studied, the title shouldn't say "sputter-deposited metals" or "sputter-deposited alloys."

- On the other hand, the title should not say "aluminum alloys" if gold was also included in the study.

- If the title had said "uniformity" rather than "compositional uniformity," the reader could easily have believed that the paper was about thickness uniformity or some other parameter.

- And if only sputter deposition was studied, then leaving this information out would make the title insufficiently specific.

## Impact of process parameters on the uniformity of aluminum alloys

# Keywords

- The important idea behind identifying the keywords to be listed under the abstract as "subject terms" is simple.

- If you were looking for an article on exactly the topic of your manuscript what words would you type into a search engine in order to find it?

- Chances are you would start with only two to four words or phrases.

- If that resulted in too many hits, or too many off-scope articles, then you would refine your search by adding one or two more phrases.

- These are the words phrases (plus all of their common variants and synonyms) that should be included in the list of subject terms.

# References

- Chris A. Mack. (2018). How to Write a Good Scientific Paper. Society of Photo-Optical Instrumentation Engineers (SPIE). ISBN: 978-1-5106-1913-5

# In Class Assignment

- Discuss your research design to your lecturer!

# Thank you