Discussion Section of a Journal Article

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MSE 478/578 Scientific Communication in Materials Science \& Engineering

IV. Discussion:

- **Introduction** - tell *why* you obtained the results.
- **Experimental** - tell *how* you obtained the results.
- **Discussion** - designed to tell *what* the results mean.
IV. Discussion:

**Anatomy of a Discussion Section:**

- **Short Summary of results**
  - *1 paragraph - 3 sentences*
- **Findings** (1-3) - tying your results together
- **Proposal/Hypothesis** - your *Knowledge Gap!*
- **Limitations of your study & how to address**
- **Brief summary of findings and proposal**
- **Ramifications/Implications/Impact**

**IV. Discussion: (cont.)**

- Show relationships between observed facts
- Decide before writing, what are the 3 most important aspects of the work that readers should know tomorrow.
  - *Supporting Idea 1 or Finding 1*
  - *Supporting Idea 2 or Finding 2*
  - *Supporting Idea 3 or Finding 3*
- Then write about each one separately.
- Discuss the results relative to:
  - The meaning of the results - what are your findings
  - The work of others
IV. Discussion: (cont.)

- Answer the questions posed in the Introduction.
- Think of the Discussion and Introduction as a complimentary pair.
- Discuss, compare & contrast aspects of figures and tables in Results section with one another and what it might mean.
- Demonstrate relationships between various data (e.g., figures, tables, etc) in Results section by:
  - Think of the Arrows connecting CTs & SIMS to your Supporting Ideas/Findings - Why are they tied together?
  - Creating plots to show relationships
  - Create a model to show relationships
  - Simulate results to show relationships
  - Use statistical analysis to show relationships
IV. Discussion: (cont.)

- Discuss what might be the meaning of the observed tendencies and trends described in the results.
  - In general, point out the behavior of the data (e.g., figures, tables, etc.).
  - Then suggest what the behavior might signify/mean/indicate.

- Ways to do this include:
  - Use a model to describe/simulate the data.
    - The model may be based on physics or phenomenological/empirical.
    - Use work of others to substantiate your model (e.g., someone else has observed the same trends or used a similar model).
    - The model may lead to ability to simulate the data.
    - Assess simulation:
      - Goodness of simulation
      - Physical validity of simulation
  - Use statistics to describe your data.
    - Show or demonstrate a certain behavior
    - Disprove a certain behavior

IV. Discussion: (cont.)

- Then show how your results & interpretations are supported with previously published work.

- Do so by using referencing, referencing, referencing!
  - Your own previously published work
  - Other published data
  - Tie the observed tendencies & trends back to the Introduction and previous work in the field you introduced in the Introduction

- I.e., Support your stance/interpretation.
IV. Discussion: (cont.)

How do I suggest what the findings/behavior might signify/mean/indicate?

- Create a scientifically credible story by proposing, predicting, or providing one (or more):
  - Conjecture
  - Generalization of the findings
  - Hypothesis
  - Model
  - Theory

- These would be supported by:
  - Your data
  - Observed trends
  - Experimental &/or simulation findings
  - The literature (referencing)

Note: This is your *Knowledge Gap*!

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IV. Discussion:

Limitations of your study

- Highlight areas in your study that are questionable
  - Be critical of your own work
  - Do not hide any gaps or assumptions in your study.
  - If you do not reveal the gaps, the reviewers will reveal them for you.

- Provide the assumptions in your study

- Describe the activity that resulted in the limitation
  - Experimental approach or technique
  - Analytical technique (e.g., instrumentation, statistical analysis)
  - Assumptions in Model &/or Simulations
  - Explain the limitation
  - Suggest how the limitation may have affected one of your conclusions

Describe how one might address the limitations
IV. Discussion: (cont.)

- Close the loop ...

- Short summary of findings and proposal

- Discussion should end with a short, clear summary or conclusion of:
  - Findings & Proposal
  - Stipulates the significance of your work
  - Summarize your evidence for each conclusion.

- Ramifications, implications - state why the findings are significant

- Theoretical Implications

- Practical Implications
IV. Discussion: Leveraging

Writing the Discussion Section promotes:
- Critical Thinking
- Creative Thinking & Innovation

As you read the work of others, use the above to your advantage
- Reverse engineer their work
- How do they represent their data?
- Borrow from them and apply it to your own work
- Did they miss an aspect of their study that you think could further fill the Knowledge Gap?

In-Class Exercise – Part 1 (20 minutes)

Go over example Discussion sections in the most applicable 2 journals to your study.

Do the following:
- Identify the major findings - how many were there?
- How did they use their results to create & support a finding?
  - Did they use only one result per finding?
  - Did they use multiple results per finding?
- What did they use beyond their results to create/support major findings?
  - Create additional data, figure, table?
  - Model?
  - Simulations?
  - Statistics?
- Reverse engineer their work
  - Come up with one aspect of their study that you think could be further fill the Knowledge Gap.
  - I.e., find something that they did not cover (i.e., missed) that you could capitalize on (i.e., leverage into your own study).
In-Class Exercise – Part 2 (10 minutes)

- Pair up (2-3 people) in teams
- Go over example Discussion sections you found from your most applicable (to your study):
  - Regular Journal and ...
  - Letter Journal articles
- Look for similarities and differences in:
  - Regular Journal article -VS- Letter Journal article
  - How they (Regular Journal article & Letter Journal article) outlined their Discussion sections versus how we outlined the abstract in class
- Examine Paragraphs Versus Figures
  - Do they correlate?
  - Paragraph structure - is there any?
    - Topic Sentence
    - Supporting Sentences (list, chain-link, combo)
    - Implication-conclusion

Tenses:

- **Tenses**: [3]
- **Present tense**:
  - For the general case and statements on what is currently known.
  - E.g., statements that are: general knowledge, widely accepted, and those that can be referenced in the present tense.
- **Past tense**:
  - Experimental results
  - Observations that were made during your study
References for this overview:


[3] Eschew Obfuscation: Advice on Writing Clearly, Larry J. Forney, Dept. of Biological Sciences, Professor Trish Hartzell, PhD. Department of Microbiology, Molecular Biology, and Biochemistry, University of Idaho, Moscow, ID; presented at the 2008 INBRE Conference, Boise, ID