How to Read a Research Paper

Why read papers?

- So you know what's happening
- Avoid reinventing the wheel
  - does happen commonly, too many wheels already
- Find interesting research topics

Why bother ourselves?

- Journal papers are current
  - Textbooks are often years out of date.
- Journals are generally the most accessible means of obtaining the information that you need.
- You can get a good explanation for your data and enough details to replicate what you read about.
- To find out exactly what the latest developments are in a field.
- To find out how a certain piece of research was done.
- Because one day soon you could be writing papers too!

Why not to read papers?

- Cannot read everything
- Should not read everything
- Can suppress innovation
  - once you see solutions using a particular theme, often hard to think differently

Read or not to read, that is the question

- Read, of course
- Know what’s important
- Know what can be ignored without significant loss of information

What to read?

- Major conferences
  - Journals are a few years behind, but still can be useful
- Tech reports from active research groups
  - need to know which groups to look up
- Survey / overview papers
  - ACM Computing Surveys
  - CACM, IEEE Computer, Spectrum
  - more technical - IEEE Personal Communications, …
  - newsletters - ACM SIGCOMM, ACM SIGMOBILE, ...

Two Types of Scientific Papers Containing Two Types of Information

There are two types of scientific papers:

Review articles: give an overview of the scientific field or topic by summarizing the data and conclusions from many studies.

Primary research articles: contain the original data and conclusions of the researchers who were involved in the experiments and how the experiments were done.

Few easy ways to distinguish between Review & Primary research

1. Many reviews will be labeled as "review“ on the first page of the article.
2. Reviews don't have a "methods" section.
3. In a review article, graphs, tables, or figures containing actual data will contain citations in the figure legend to the primary research papers that originally reported the findings.

Research Papers

- Primary form in which research results are disseminated in computer science
- Conference papers (shorter)
- Journal papers (longer)
  - Often the complete version of a conference paper
  - May come out several years after the conference paper

Where to find a paper?

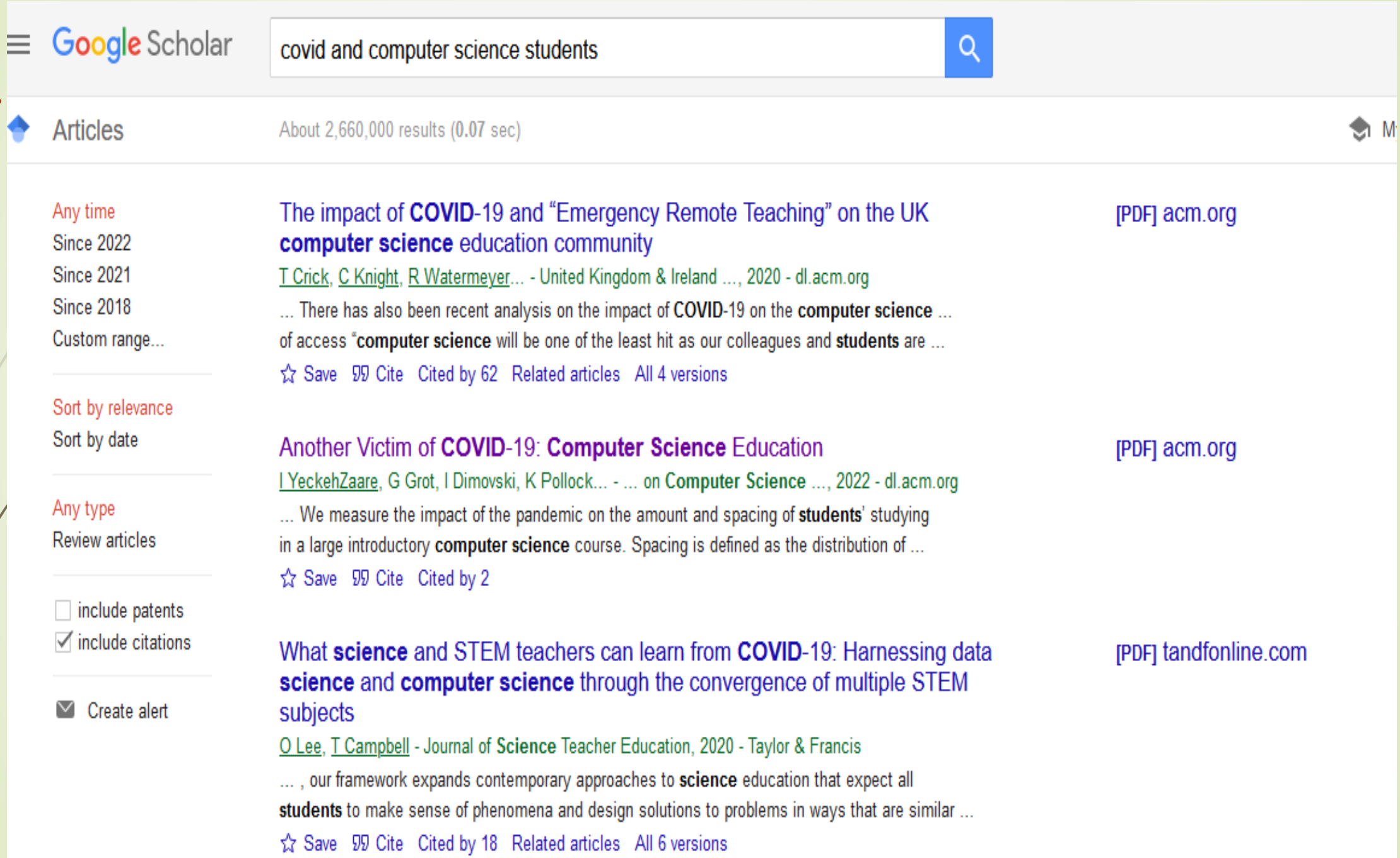
- http://digitallibrary.edu.pk/natunicomp_emrgsc.html
- http://www.digitallibrary.edu.pk/
- https://www.proquest.com/
- https://sci-hub.do/

Database	Publisher	Journals
• Web of Science • Scopus	• Springer. • Palgrave Macmillan. • Routledge. • Cambridge University Press. • Elsevier. • Nova Science Publishers. • Edward Elgar. • Information Age Publishing.	

How to Find the Quality of Paper?

- https://hjrs.hec.gov.pk/
- https://www.scimagojr.com/

- https://scholar.google.com/


Google Scholar
covid and computer science students
Articles
About 2,660,000 results (0.07 sec)
Any time
Since 2022
Since 2021
Since 2018
Custom range...
Sort by relevance
Sort by date
Any type
Review articles
include patents
include citations
Create alert
The impact of COVID-19 and "Emergency Remote Teaching" on the UK computer science education community
[PDF] acm.org
T Crick, C Knight, R Watermeyer... - United Kingdom & Ireland ..., 2020 - dl.acm.org
... There has also been recent analysis on the impact of COVID-19 on the computer science ...
of access "computer science will be one of the least hit as our colleagues and students are ...
Save Cite Cited by 62 Related articles All 4 versions
Another Victim of COVID-19: Computer Science Education
[PDF] acm.org
I YeckehZaare, G Grot, I Dimovski, K Pollock... - ... on Computer Science ..., 2022 - dl.acm.org
... We measure the impact of the pandemic on the amount and spacing of students' studying
in a large introductory computer science course. Spacing is defined as the distribution of ...
Save Cite Cited by 2
What science and STEM teachers can learn from COVID-19: Harnessing data science and computer science through the convergence of multiple STEM subjects
[PDF] tandfonline.com
O Lee, T Campbell - Journal of Science Teacher Education, 2020 - Taylor & Francis
... , our framework expands contemporary approaches to science education that expect all
students to make sense of phenomena and design solutions to problems in ways that are similar ...
Save Cite Cited by 18 Related articles All 6 versions

RESEARCH-ARTICLE

Another Victim of COVID-19: Computer Science Education

Authors: Iman YeckehZaare, Gail Grot, Isadora Dimovski, Karlie Pollock, Elijah Fox Authors Info & Claims

SIGCSE 2022: Proceedings of the 53rd ACM Technical Symposium on Computer Science Education V. 1 • February 2022 • Pages 913–919 • https://doi.org/10.1145/3478431.3499313

Online: 22 February 2022 Publication History

Instructional Methods in STEM Education: A Cross-contextual Study

Full Text (PDF)

Andreasa Zendler [1] *, Cornelia Seitz [1], Dieter Klaudt [1]

More Detail

Article Type: Research Article

https://doi.org/10.29333/ejmste/91482

EURASIA J Math Sci Tech Ed, 2018 - Volume 14 Issue 7, pp. 2969-2986

Publication date: 12 May 2018

Abstract

This study contributes to an integrative view on STEM subjects from an educational point of view. The focus is on the assessment of instructional methods in relation to knowledge processes. By a questionnaire, computer science teachers and mathematics teachers assessed 20 instructional methods in terms of knowledge processes (build, process, apply, transfer, evaluate, and integrate). The findings show that computer science teachers and mathematics teachers differ on the rating of instructional methods. However, the findings also allow a common way of looking at instructional methods by computer science teachers and mathematics teachers. This is an important result for pre- and in-service training programs and for the introduction of computer science as a new school subject.

Keywords

STEM | computer science education | mathematics education | instructional methods | knowledge processes | cross-contextual research

What’s in a paper?

- Abstract
- Introduction
- Motivation
- Problem description
- Solution
- Performance Analysis
- Conclusions
- Future Work

How to read a paper?

Know why you want to read the paper

- To know what's going on (e.g., scanning proceedings)
  - title, authors, abstract
- Papers in your broad research area
  - introduction, motivation, solution description, summary, conclusions
  - sometimes reading more details useful, but not always
- Papers you may want to improve on
  - read entire paper carefully

What to note?

- Authors and research group
  - Need to know where to look for a paper on particular topic
- Theme of the solution
  - Should be able to go back to the paper if you need more info
- Approach to performance evaluation
- Note any shortcomings

Reading a Paper Critically

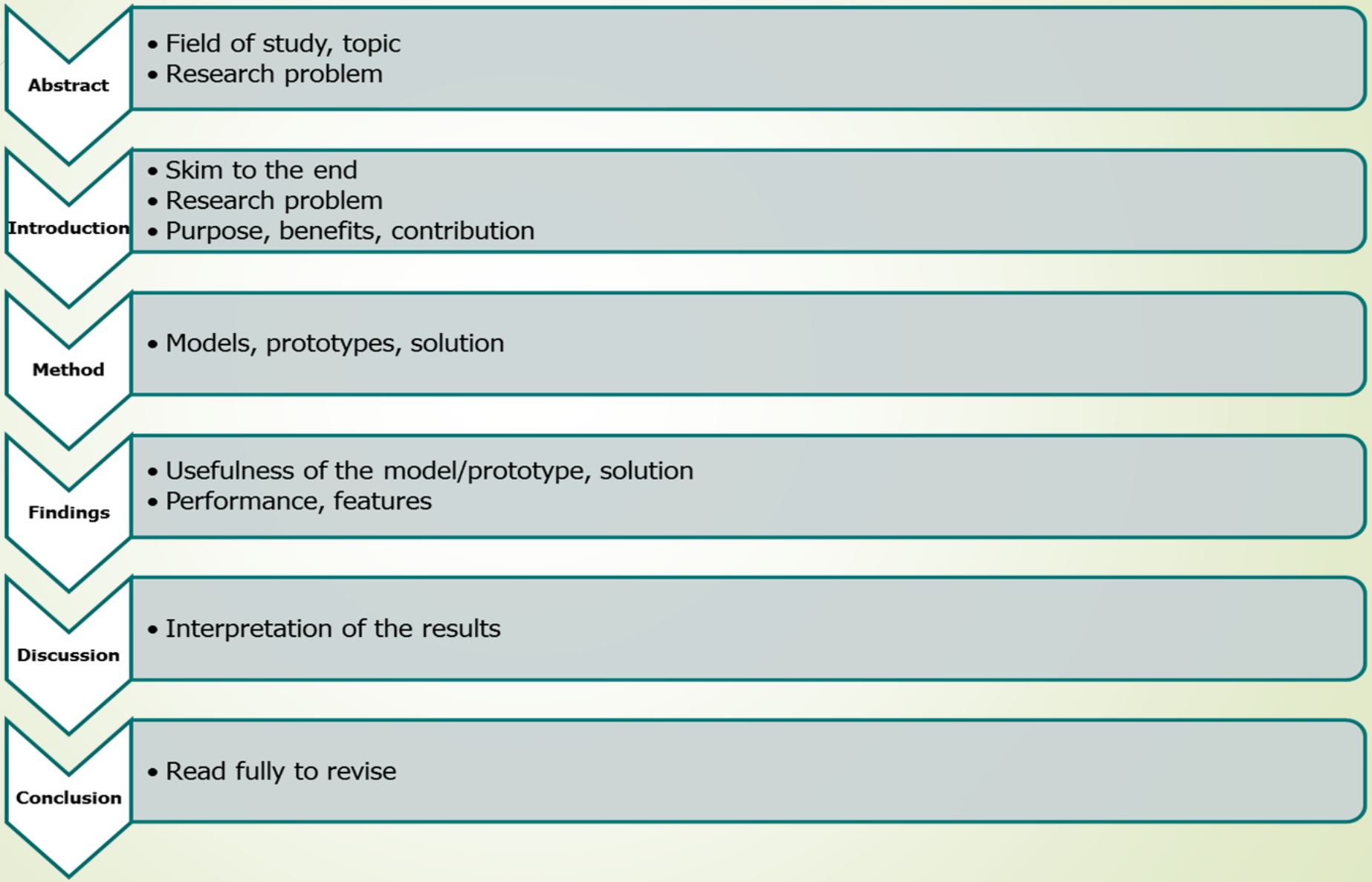
- Understand the problem
- Understand the proposed solution
- Understand competing approaches / designs
- Evaluate the paper

- Peer review is the cornerstone of the scientific publishing process

Why?

- Learn to do research
- Learn to think critically about quality of research papers
  - Someone will be thinking critically about your own work!
  - In any discipline, there are fads and there are lasting ideas… learn to tell the difference!
- Gain perspective
- Key issue: what are the questions to ask?

Anatomy of a Research Article



Evaluating a Paper

- What is the problem being solved?
  - Is it important? Relevant? Why?
  - What is the prior work in this area?
- Is the proposed solution clever?
  - Cleverness is orthogonal to importance!
- Are the assumptions and model reasonable?
- Impact
  - Easier to evaluate for older papers
  - Does other work build on it? Do other papers use techniques and solutions proposed in this paper?

Evaluation Process

- Read slowly, take notes as you read
  - Question assumptions, importance of the problem
  - Write questions to track what you don’t understand
- Sometimes what is not in the paper is more important than what is in it
  - Is there something the authors have overlooked?
- Don’t let ideas or design details pass until you understand them!
- Do not assume the paper is correct, even if published in a prestigious peer-reviewed venue

Title and authors

- Title is very descriptive (often states the main finding) and is not about being creative and “catchy”!
- Order of authors is important. What can you tell from it?

Computation on Stochastic Bit Streams Digital Image Processing Case Studies

Peng Li ; David J. Lilja ; Weikang Qian ; Kia Bazargan ; Marc D. Riedel

Abstract/Summary

- Brief background of subject
- Purpose for the study
- Major findings of the study
- Relationship between these findings and the field

- *This is what you see when you do a google search. You can decide if the paper is worth reading based upon this.*

Introduction

- Presents the background information for a fellow scientist (possibly in another field) to understand why the findings of this paper are significant.

- Structure is usually:

  - Accepted state of knowledge in the field
  - Focus on a particular aspect of the field, often the set(s) of data that led directly to the work of this paper
  - Hypothesis being tested
  - Conclusions (scientists don’t really like surprise endings!)

How to approach the introduction

- **Grab a blank piece of paper:**
  - Take notes
  - Draw mini figures
  - Define vocabulary

    (wikipedia is a quick reference)

- **Answer these questions:**
  - What is the accepted state of knowledge?
  - What data led directly to the work of this paper?
  - What is the hypothesis being tested?
  - What are the basic conclusions? (Scientists don’t really like surprise endings and this is usually stated in the last paragraph.)

Materials and Methods

- Should be detailed enough for another scientist to replicate the work (volumes, times, company material was purchased from etc.)
- In reality, often compressed and you may need to look up another paper that is referenced for more detail.

Should you read the materials and methods?

- Often you can skim over them before the results.
- However, when you get to the results, you will need to flip back to them often to clarify how experiment was done.
  - Sample number? (*Did they do this more than once?)*
  - Conditions?

Results

- While the introduction poses the questions being asked, the results describes the outcome of the experiments that were done to answer the questions.
- Results are often simply stated with *interpretation* of them coming later in the discussion.
- Figures and tables allow the reader to see the outcomes of the experiments for themselves!

How to read the results:

- Read the text straight through, but as a figure is referred to, examine the figure.
- Take notes, giving yourself a place to refer to about each figure.
- With each experiment/figure you should be able to explain :
  - **1) the basic procedure**
  - **2) the question it sought to answer**
  - **3) the results**
  - **4) the conclusion**
  - **5) criticisms**

Discussion

- Data is analyzed to show what the authors believe the data show. (You don’t have to agree with their interpretations!)
- Findings are related to other findings in the field (contribute to knowledge, correct errors, etc.)– How is this work significant?

How to read a discussion

Take notes and answer these questions:

- What conclusions do the authors draw? Be sure to separate fact from their opinion/interpretation?
- Describe for yourself why these data significant. (Does it contribute to knowledge or correct errors?)

Question: How should we READ a scientific paper?

- Step 1: Skim the entire paper
- Step 2:Vocabulary
- Step 3: Read for comprehension, section by section
- Step 4: Reflection and criticism

Step 4: Reflection and criticism

- Do you agree with the authors' rationale for setting up the experiments as they did?
- Did they perform the experiments appropriately? (Repeated a number of times, used correct control groups, used appropriate measurements etc)
- Were there enough experiments to support the one major finding they are claiming?
- Do you see patterns/trends in their data that are problems that were not mentioned?
- Do you agree with the authors' conclusions from these data? Are they over-generalized or too grand? Or are there other factors that they neglect that could have accounted for their data?
- What further questions do you have? What might you suggest they do next?

Template for Taking Notes on Research Articles

1. Complete Citation: Author(s), Date of Publication, Title, Journal, Volume, Issue, Pages
2. Key words
3. General subject
4. Specific subject
5. Hypothesis / Question
6. Methodology
7. Result(s)
8. Summary of Key Points
9. Context (how this article relates to other work in the field; how it ties in with key issues findings by others, including yourself)
10. Significance (to the field; in relation to your own work):
11. Important Figures and/or Tables (brief description; page number):