Reading & Reviewing Scientific Papers

Kai Chan, EOS – June 10, 2008
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Twenty three attended this "brownbag" discussion / presentation, with Kai Chan leading and Douw Steyn supporting. This document summarizes content from the presentation slides. First, some context about when and where the reading exercise is carried out:

- Thirty five 3rd or 4th year students
- The exercise arose partly in response to the shift in emphasis (for both envr core courses) from *content* towards *active learning*.
- In-class work is done in groups of 3, with roles rotated.
- Three papers were read. Content was new and relevant to the course (Environmental Monitoring, Science for Sustainable Systems, and Environmental Modelling).
- Four 80 minute sessions
- Done near the end of term (not at the beginning)
- Conducted primarily by Kai Chan and Douw Steyne, with support from one TA (name?)
- The 4-day exercise addresses many course goals – see "Why carry out …" below.
- The exercise is also effective at supporting the goal of helping students distinguish between data, interpretations, models, theories, and hypotheses.
- A framework for learning this material is embedded within the questions being posed at each of the six stages (numbered 1-6 below) of the process.

Next, some comments on discussions during and following the presentation:

- How students used home and class time,
- Ways that group work and peer assessment were implemented. Groups were randomly assigned (with care), peer assessment followed rubrics provided (I think?)
- Pros and cons of delivering this exercise early or late in a course. Late is better if content is needed, early is better if papers being read during the exercise are not "technical". Also there was some discussion about whether the framework might be useful early in the course while the actual exercise is conducted late.
- Students don't always distinguish clearly between finding and processing information. This exercise supports building that skill.
- Question about whether scientific writing skills could be incorporated into an exercise like this, but no conclusion.
- A question was asked about when students get a chance to take positions or debate – answer is in other aspects of envr300 (and envr200).

An outline of the presentation follows.

Presentation outline
- Why read articles?
- How to go about getting the most out of the article?
- When implemented in class, an example. When presenting to faculty, discuss the process.

Why carry out a science article reading exercise?

Answered by relating this exercise to envr300's learning goals:
- Critically review research papers
- The exercises addresses all listed conceptual skills goals
- Work is in groups, with each student filling all roles
- Find information; formulate question (Q) and design methods to test it; review information to illuminate Q.

Concerning "critical review" of an article:
- This is a fundamental component of science research
- It is almost never taught, yet most science professionals must critically read articles.
- One can usually find some 'hole' in an article
- The process is not always about critique; also construction – ie constructive criticism.

What are possible reasons you might be reading the paper?
- Understand the issue at the source
    - For accuracy, your purposes
    - For empowerment
    - For application beyond
- As a professional duty, and/or for recognition
- Gives ideas, hones thinking, supports reflection about your work / research / teaching.

There are many ways to read, but some key principles are given here, which serves as a head start.

How to carry out the task:

While reading, first consider the structure of the article. It may not have these sections explicitly but they will be there in some form or other:
1. Introduction: Context
2. Introduction: Research Q
3. Methods: Data
4. Methods: Analysis
5. Results
6. Discussion

Now - Stop! Before you read in detail, answer these questions!
- What's **my** purpose for reading it?

- Title — is it promising?
- Authors — are they authorities?
- Abstract.

Finally read the article

The remainder of these guidelines is in the form of questions to consider about each section listed above (Context, Research Q, Methods, Data, Analysis, Results, and Discussion). As well as considering content, keep in mind "*How effectively was the article written*"?

1. Context
    a. What's the author's purpose?
        i. How important?
    b. Who's the intended audience?
    c. What is the broader context?
        i. In the real world?
        ii. In research?

2. Research Questions
    a. What kind of paper? (Article, response, essay, review, policy forum)
    b. What is the research Q or thesis?
        i. How testable?
        ii. Connection to author's purpose
        iii. How relevant & innovative …
            1. In real world?
            2. In research?

3. Data: What methods? (Existing data, experiment, theory, model)
    a. Appropriateness for purpose or Q
    b. Approp./innovation in field
    c. Assumptions:
        i. justifiability given Q, data?
        ii. sensitivity analyses?
    d. Improvements?

4. Analysis: What methods? (Qualitative, statistical, meta-analysis, proof)
    a. Appropriateness for purpose/Q
    b. Approp./innovation in field
    c. Assumptions:
        i. justifiability given Q, data?
        ii. sensitivity analyses?
    d. Improvements?

5. Results: What main result?
    a. What is observation vs. interpretation?
    b. How likely impacted by key data/analysis assumptions?
    c. How general/generalizable?

6. Discussion
    a. How reductionist/holistic?
    b. Temporal/spatial scale of patterns, processes, analyses
    c. Uncertainty, bias?
    d. What literature do they discuss, what else pertains?
    e. How can others build?
    f. How does this change thinking?

If you are writing a Review, here are some considerations:
- Their purpose
- Strengths/achievements
- Weaknesses/limitations
- Suggestions, both major and minor

Finally, take home messages include:
- Reading & reviewing is a crucial component of science
- Your purpose comes first
- Answer Qs of various kinds, re: author's purpose
- Reviewing: purpose, strengths, weaknesses, suggestions