Research Literacy Workshop

Prepared by

Reem El Sherif, Pierre Pluye, Vera Granikov, Quan Nha Hong

UNITÉ DE SOUTIEN
SRAP | QUÉBEC

McGill | Department of Family Medicine

Research Literacy Workshop

Research literacy is defined as having familiarity with scientific ethics and methods sufficient to understand basic research concepts (knowledge), communicate with researchers and research participants (behavior), and respect research ethics (attitude). Adapted from Nebeker & López-Arenas, Building Research Integrity and Capacity (BRIC), J Microbiol Biol Educ, 2016, 17(1):41-5.

Context

This resource is used in conjunction with the Research Literacy workshop. The audience of the workshop includes patients, administrative staff, clinicians, managers, and anyone interested in research and collaboration with researchers (hereafter research stakeholders). The goal is to allow research stakeholders to find, understand and use a common language.

Contents

Ethics

Participants are encouraged to do at least module 1 offered by the FRQS:
http://ethique.msss.gouv.qc.ca/didacticiel/
The following content has been adapted from the FRQS modules.

Historical context

Research involving humans has been part of medicine for centuries. In the nineteenth century, research involving humans truly emerged with the adoption of the experimental method in both science and medicine. By the beginning of the twentieth century, the idea of conducting research involving humans was becoming more acceptable if extensive studies were first conducted on animals. Unfortunately, research studied in bacteriology at the end of the nineteenth century and beginning of the twentieth century across North America and Europe involved some highly questionable practices. Although medical and scientific associations condemned these practices, they did not result in any professional, disciplinary or criminal charges. It is only following the second World War and the Nuremberg trials that such charges were laid. The judges' verdict in 1947 included a section entitled "Permissible Medical Experiments" which described ten principles to be followed in conducting research on humans. Known today as the "*Nuremberg Code*", it states as its first principle that "the voluntary consent of the human subject is essential."

In Canada

A key step to ensure the ethical acceptability of a project is to have an independent review (i.e., not the principal investigator). The first Canadian requirement for an independent review of research protocols by a Research Ethics Board (REB) was in the 1978 *Medical Research Council* guidelines. In 1998, the *Medical Research Council* (now the Canadian Institutes of Health Research-CIHR) together with two other federal research councils, the *Natural Sciences and Engineering Research Council* (NSERC) and *Social Sciences and Humanities Research Council* (SSHRC), published a single set of guidelines: **The *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans* (TCPS)** for research involving humans regardless of the field of research.

The TCPS was revised extensively and a new version was published in 2010 (TCPS2). The TCPS and TCPS2 view the ethical principles as expressions of the overarching value of human dignity and a "compass" to providing necessary protections for research participants while serving legitimate needs of research. Along with the identification and application of principles to guide ethical research, these regulations set out a process for ethics review. As a result, researchers are no longer allowed to assess the ethical acceptability of their research projects on their own. **REBs have the authority to review and approve research projects that involve humans.** The primary mandate of the REB is the protection, safety and well-being, of all human participants involved in research conducted under the institution's responsibility.

Resources

https://researchethics.ca/what-is-research-ethics/
http://www.hc-sc.gc.ca/sr-sr/advice-avis/reb-cer/ethi-res/index-eng.php

Literature Reviews

(Adapted from the syllabus of the FMED 500 course by Dr. Jeannie Haggerty)

A literature review is a "search and evaluation of the available literature in your given subject or chosen topic area" (Royal Literary Fund 2017).

Types:

1) Narrative review: This type of review critiques and summarizes a body of literature on a specific topic and draws conclusions about the topic in question.
2) Best evidence synthesis: Best evidence synthesis is a variant of the narrative review. In this type of review, only high-quality evidence is included in the synthesis.
3) Systematic reviews: Systematic reviews use a rigorous method to provide a complete summary of the literature on a specific topic. Two independent reviewers carry out each of the key steps: study selection, study quality appraisal, data extraction and data synthesis. The goal is to decrease as much bias as possible in the way that documents are selected, extracted, and synthesized.
4) Meta-analysis: Meta-analysis is a synthesis technique used in systematic reviews. Many single studies are not sufficiently large to demonstrate statistically significant effects, or studies may have contradictory findings. This technique pools the data from all the studies and conducts statistical analysis on the body of the findings to arrive at a single result of the overall effect.

Steps	**Description**
Object of study	Define the types of documents to be included, the inclusion and exclusion criteria.
Selection	• Use a search strategy in bibliographic databases to identify potential articles • Select studies using selection criteria: ○ Scan titles ○ Scan abstracts ○ Retrieve the full text versions of potentially relevant articles ○ Look at reference lists of retained studies to identify additional relevant studies
Data extraction	Extract specific information (data) from each study
Quality appraisal	Appraise the quality of selected studies using one of many different quality appraisal tools
Synthesis	Analyze the results across included studies

Resources

https://www.youtube.com/watch?v=ep3BRgRJ2N4
http://pareonline.net/pdf/v14n13.pdf
https://www.youtube.com/watch?v=egJlW4vkb1Y

Qualitative Research

(Adapted from the syllabus of the FMED 500 course by Dr. Jeannie Haggerty)

'Qualitative Research…involves finding out what people think, and how they feel - or at any rate, what they say they think and how they say they feel. This kind of information is subjective. It involves feelings and impressions, rather than numbers' (Bellenger, Bernhardt and Goldstucker, Qualitative Research in Marketing, 2011 American Marketing Association).

Qualitative researchers:

- Spend a great deal of time in the settings being studied (fieldwork);
- Rely on themselves as the main instrument of data collection (subjectivity; intersubjectivity);
- Analyze data by trying to interpret it;
- Employ expressive language in descriptions and explanations;
- Seek depth of perspective through ongoing analysis (i.e., "waves of data");

Qualitative work is judged in terms of believability, trustworthiness, coherence, and the logic underlying researcher' s interpretations.

Steps	**Typical qualitative study**
Object of study	Typically, in qualitative studies, the number of subjects is small, so you will be looking for typical cases, and then some "maximum variation" around the phenomenon of interest.
Selection or recruitment	Methods commonly used to identify potential subjects are: • Purposive; • Word of mouth (snowballing); • Case quota (representative data from a group).
Data collection	Examples of study design most commonly used are: • individual interviews; • focus groups; • reflective writing; • photo-voice; • arts-based inquiry; • ethnography with participant or non-participant observation.
Synthesis or analysis	The specific analytic approach differs by study, but the most common one is thematic analysis, which involves categorization of the data – grouping it into recurring themes through a process called coding.

Resources

Epidemiology

(Adapted from the Centers of Disease Control and Prevention, Introduction to Epidemiology, retrieved May 28th 2017 https://www.cdc.gov/publichealth101/epidemiology.html)

Epidemiology is "the branch of medicine that deals with the incidence, distribution, and possible control of diseases and other factors relating to health" (Oxford dictionary).
Epidemiology relies on a systematic and unbiased approach to the collection, analysis, and interpretation of data. Basic epidemiologic methods tend to rely on careful observation and use of valid comparison groups to assess whether what was observed differs from what might be expected, such as the number of cases of disease in an area during a particular time period or the frequency of an exposure among persons with disease. However, epidemiology also draws on methods from other scientific fields, including **biostatistics** (explained below) and informatics, biologic, economic, social, and behavioral sciences.

Common terms

- **Frequency** refers to the number of health events such as the number of cases of meningitis or diabetes in a population, and to the relationship of that number to the size of the population.
- **Pattern** refers to the occurrence of health-related events by time, place, and person.
- **Determinants** are the causes and other factors that influence the occurrence of disease and other health-related events.

Uses/examples

Epidemiology originally focused exclusively on epidemics of communicable diseases, and then expanded to address endemic communicable diseases and non-communicable infectious diseases, for example: chronic diseases, maternal-child health, amount of exercise and seat belt use.

Types of studies

1. Experimental studies: the investigator determines through a controlled process the exposure for each individual (clinical trial) or community (community trial), and then tracks the individuals or communities over time to detect the effects of the exposure.
2. Observational studies
   - cohort study: investigators records whether each study participant is exposed or not, and then tracks the participants to see if they develop the disease of interest
     - prospective: enroll participants as the study begins and then follow them prospectively over time to identify if the outcomes of interest occur
     - retrospective: both the exposure and the outcomes have already occurred
   - case-control study*:* investigators enrolls a group of people with a disease and a group without the disease (controls). Investigators then compare previous exposures to different factors between the two groups.
   - cross-sectional study: a sample of persons from a population is enrolled and their exposures and health outcomes are measured simultaneously.

Resources

CDC https://www.cdc.gov/OPHSS/CSELS/DSEPD/SS1978/Lesson1/Section1.html#_ref1

Biostatistics

(Adapted from **Basic Concepts for Biostatistics 2016, by** Lisa Sullivan, PhD, Professor of Biostatistics, Boston University School of Public Health https://goo.gl/nEuADS, retrieved May 28th, 2017)

Association of Schools of Public Health (ASPH) defines biostatistics as “the development and application of statistical reasoning and methods in addressing, analyzing and solving problems in public health; health care; and biomedical, clinical and population-based research”.

Basic concepts in statistics

- "**N**" is usually used to indicate the number of subjects in a study
- **Mean**: the average result of a test, survey, or experiment.
- **Median**: the score that divides the results in half - the middle value.
- **Mode:** the most common result (the most frequent value) of a test, survey, or experiment.
- **Significance:** the measure of whether the results of research were due to chance. The more statistical significance assigned to an observation, the less likely the observation occurred by chance.
- **p-value**: the way in which significance is reported statistically (i.e. $p<.01$ means that there is a less than 1% chance that the results of a study are due to random chance). Note that generally p-values need to be fairly low (.01 and .05 are common) in order for a study to make any strong claims based on the results.
- **Correlation:** the degree to which two factors appear to be related. Correlation should not be confused with causation. Just because two factors are reported as being correlated, you cannot say that one factor causes the other.

Basic concepts in biostatistics

- **Subjects:** the units on which characteristics are measured (most frequently humans, but might also be cells in culture or animals)
- **Population** is the collection of all subjects of interest.
- **Sample**: a subset of the population of interest.
- **Variables:** characteristics which are being measured and/or recorded. For e.g., body weight, age, gender, serum cholesterol levels, and tobacco use might be variables of interest.

- **Statistical Inference:** we usually don't have information about all the subjects in a population of interest, so we take samples from the population to make inferences about unknown population measures.

*Ideally, the sample should be:

- **representative** of the population;
- a **random** sample, meaning that all subjects in the population have an equal chance of being selected into the sample; this would minimize systematic errors caused by biased sampling;
- **large** so they are less likely to be affected by "the luck of the draw"; this would reduce so-called random error.

Mixed Methods Research

Adapted from FoodRisc Resource Centre, Research Methods 2016, http://resourcecentre.foodrisc.org/mixed-methods-research_185.html retrieved May 30th, 2017)

Definition and Uses

Mixed methods research is a methodology for conducting research that involves collecting, analysing and integrating quantitative (e.g., experiments, surveys) and qualitative (e.g., focus groups, interviews) research. This approach to research is used when this integration provides a better understanding of the research problem than either of each alone.

Advantages

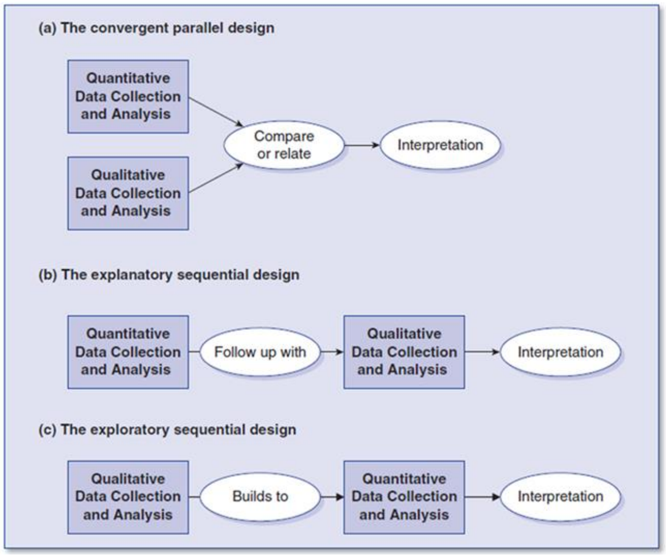
- The strengths of each approach can make up for the weaknesses of the other;
- Provides a more complete and comprehensive understanding of the research problem than either quantitative or qualitative approaches alone;
- Provides an approach for developing better, more context specific instruments;
- Helps to explain findings or how causal processes work.

Disadvantages

- The research design can be very complex.
- Takes much more time and resources to plan and implement this type of research.
- It may be difficult to plan and implement one method by drawing on the findings of another.
- It may be unclear how to resolve discrepancies that arise in the interpretation of the findings.

Ways of integrating qualitative and quantitative data

(From Creswell and Plano Clark (2011) book (p.69))

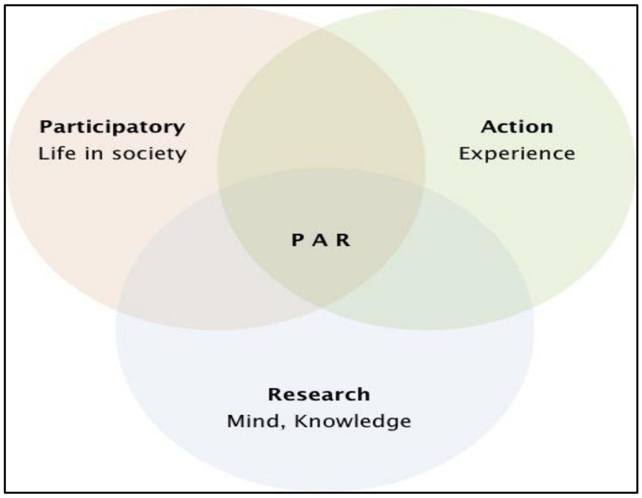


Resources

Community-Based & Organizational Participatory Research

(Adapted from Chevalier, J.M. and Buckles, D.J. (2013) Participatory Action Research: Theory and Methods for Engaged Inquiry, Routledge UK)

Participatory Action Research



Participatory action research (PAR) is an approach to research in communities that emphasizes participation and action. It seeks to understand the world by trying to change it, collaboratively and following reflection.

PAR practitioners make a concerted effort to integrate three basic aspects of their work: participation (life in society and democracy), action (engagement with experience and history), and research (soundness in thought and the growth of knowledge).

Community-based participatory research (CBPR) is a partnership approach to research that equitably involves, for example, community members, organizational representatives, and researchers in all aspects of the research process and in which all partners contribute expertise and share decision making and ownership. The aim of CBPR is to increase knowledge and understanding of a given phenomenon and integrate the knowledge gained with interventions and policy and social change to improve the health and quality of life of community members. *(M. Minkler & N. Wallerstein (Eds.), Community-based participatory research for health: From process to outcome)*

Organizational Participatory Research blends research and action to produce knowledge that can improve organization practices. Organization members may be consulted by researchers (passive participation) or work with researchers making decisions (active participation) throughout the research process. (*P. Bush et al., Organizational Participatory Research: Is it worth it?* https://goo.gl/lxUjVx [accessed Jun 4, 2017]).

Participatory Research Partner Roles

(Based on: Macaulay AC, Gibson N., Freeman W, et al. Participatory Research Maximizes Community and Lay Involvement. BMJ 1999;319:774 -778)

1. Setting research goals and objectives
2. Deciding on methods and duration of projects
3. Setting strategy and content of evaluation; Data collection
4. Interpretation of data
5. Joint dissemination of results in community language and scientific terms to communities, clinicians, administrators, scientists, and funding agencies

Resources

http://www.cihr-irsc.gc.ca/e/44954.html

Databases and "Big Data"

Databases

"A database is a collection of information that is organized so that it can be easily accessed, managed and updated. A database management system (DBMS) is a type of software that allows you to define, manipulate, retrieve and manage data stored within a database. A relational database is a collection of data items organized as a set of formally-described tables from which data can be accessed or reassembled in many ways without having to reorganize the database tables". (http://searchsqlserver.techtarget.com/definition/database, Accessed June 4th, 2017)

Big data

Big data is a term for "data sets that are so large or complex that traditional data processing application software is inadequate to deal with them." Crawford, Kate (September 21, 2011). "Six Provocations for Big Data". Social Science Research Network.

Every day, we create 2.5 quintillion bytes of data — so much that 90% of the data in the world today has been created in the last two years alone. This data comes from everywhere: sensors used to gather climate information, posts to social media sites, digital pictures and videos, purchase transaction records, and cell phone GPS signals to name a few. This data is big data. (IBM, 2017)

Big Data Research

Adapted from http://www.sciencedirect.com/science/article/pii/S2214579615000076)

Big data has caused the scientific community to re-examine its methodology of scientific research and has triggered a revolution in scientific thinking and methods. Big data technologies and the corresponding fundamental research have become a research focus in academia. An emerging interdisciplinary discipline called data science has been gradually coming into place. This takes big data as its research object and aims at generalizing the extraction of knowledge from data. It spans across many disciplines, including information science, mathematics, social science, network science, system science, psychology, and economics. It employs various techniques and theories from many fields, including signal processing, probability theory, machine learning, statistical learning, computer programming, data engineering, pattern recognition, and high-performance computing.

Resources

http://content.healthaffairs.org/content/33/7/1123.short
http://jamanetwork.com/journals/jama/fullarticle/1674245

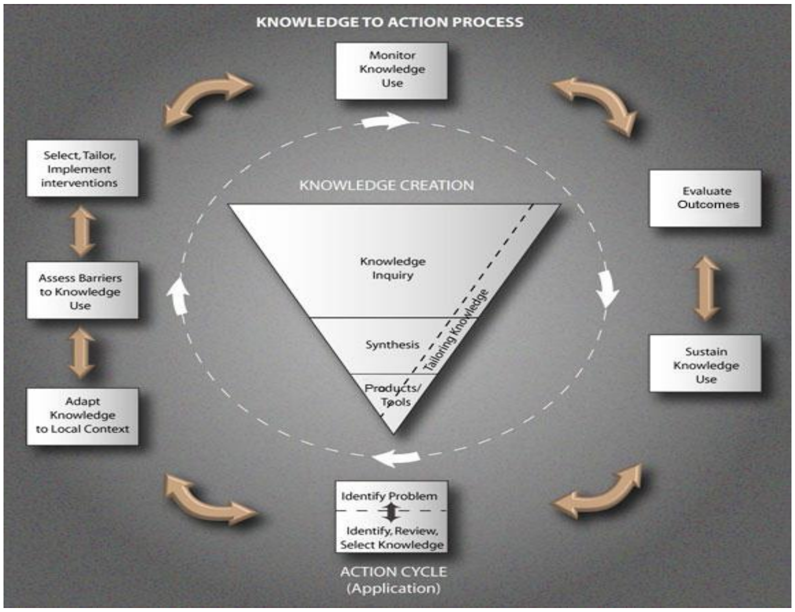
Knowledge Translation

(Adapted from CIHR http://www.cihr-irsc.gc.ca/e/29418.html#2 accessed June 4th, 2017)

Knowledge Translation (KT) is term commonly used to describe the activities and processes involved in moving knowledge acquired through research to people and organizations, who can use it in real-world setting. The CIHR defines KT as "a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to improve the health of Canadians, provide more effective health services and products, and strengthen the health care system".

The KT process could be viewed as a spectrum of interactions between researchers and knowledge users (individuals who are likely to be able to use research results to make informed decisions about health policies, programs and/or practices). It is a spectrum because the interactions may vary in intensity, complexity and level of engagement depending on the nature of the research, research findings, and knowledge users' needs.

The Knowledge to Action Process is complex and iterative; it conceptualizes the relationship between knowledge creation and action. At the center of the process is a knowledge creation "funnel" representing the idea that knowledge needs to be "distilled" before it is ready for application, "tailoring" research findings to products or tools that are easy to use. The action or application part of the process can be thought of as a cycle. In contrast to the knowledge funnel, the action cycle represents the activities that may be needed for knowledge application in practice.

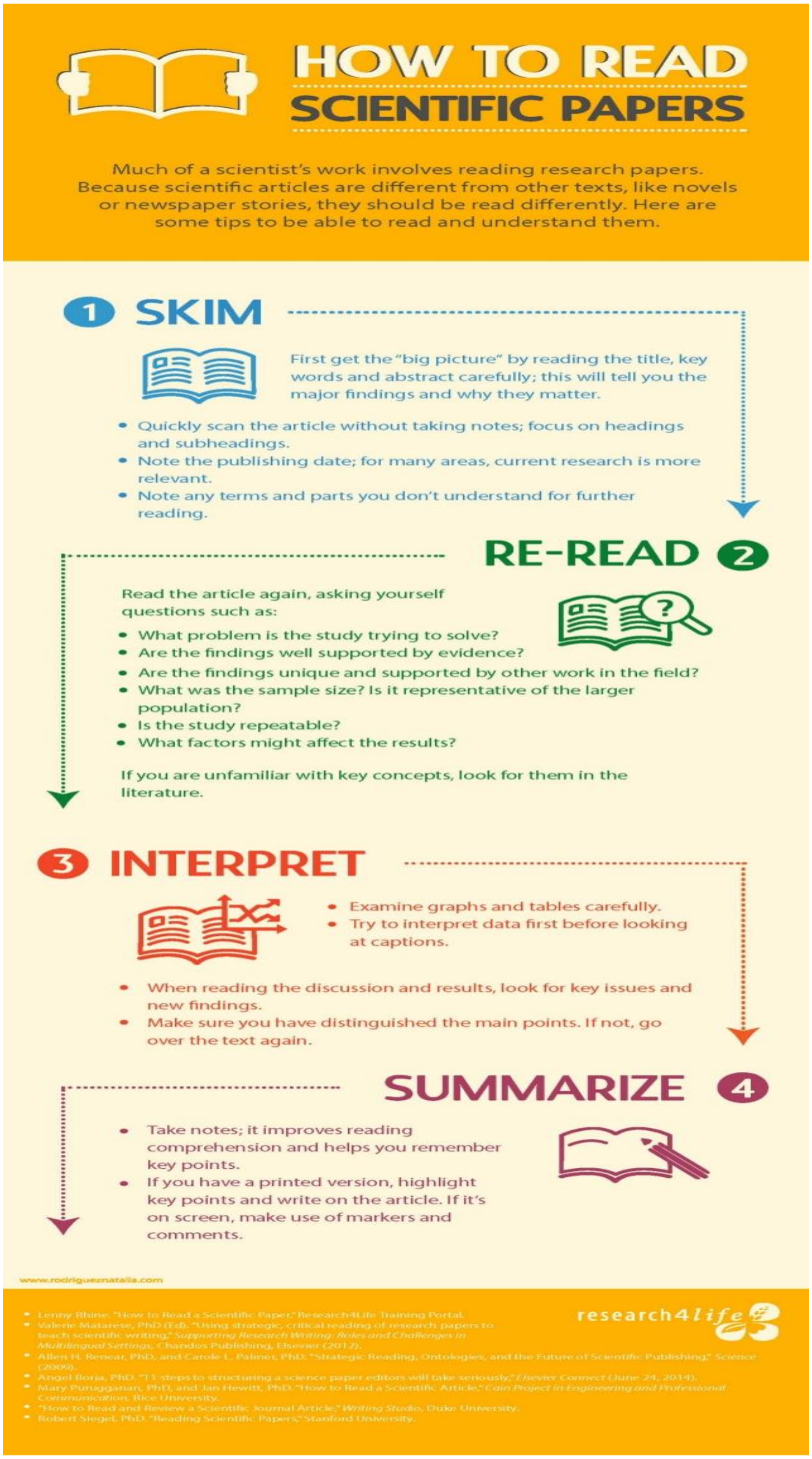


Resources

Knowledge Translation at CIHR http://www.cihr-irsc.gc.ca/e/29418.html#2
http://www.parachutecanada.org/downloads/resources/KT_Tools.pdf

How to read a research paper/protocol

Mastering this skill can help you excel at research, peer review – and writing your own papers by Natalia Rodriguez
https://www.elsevier.com/connect/infographic-how-to-read-a-scientific-paper



HOW TO READ SCIENTIFIC PAPERS

Much of a scientist's work involves reading research papers. Because scientific articles are different from other texts, like novels or newspaper stories, they should be read differently. Here are some tips to be able to read and understand them.

1 SKIM

First get the "big picture" by reading the title, key words and abstract carefully; this will tell you the major findings and why they matter.

- Quickly scan the article without taking notes; focus on headings and subheadings.
- Note the publishing date; for many areas, current research is more relevant.
- Note any terms and parts you don't understand for further reading.

RE-READ 2

Read the article again, asking yourself questions such as:

- What problem is the study trying to solve?
- Are the findings well supported by evidence?
- Are the findings unique and supported by other work in the field?
- What was the sample size? Is it representative of the larger population?
- Is the study repeatable?
- What factors might affect the results?

If you are unfamiliar with key concepts, look for them in the literature.

3 INTERPRET

- Examine graphs and tables carefully.
- Try to interpret data first before looking at captions.
- When reading the discussion and results, look for key issues and new findings.
- Make sure you have distinguished the main points. If not, go over the text again.

SUMMARIZE 4

- Take notes; it improves reading comprehension and helps you remember key points.
- If you have a printed version, highlight key points and write on the article. If it's on screen, make use of markers and comments.

www.rodrigueznatalia.com

- Lenny Rhine. "How to Read a Scientific Paper," Research4Life Training Portal.
- Valerie Matarese, PhD (Ed). "Using strategic, critical reading of research papers to teach scientific writing," *Supporting Research Writing: Roles and Challenges in Multilingual Settings*, Chandos Publishing, Elsevier (2012).
- Allen H. Renear, PhD, and Carole L. Palmer, PhD. "Strategic Reading, Ontologies, and the Future of Scientific Publishing," Science (2009).
- Angel Borja, PhD. "11 steps to structuring a science paper editors will take seriously," *Elsevier Connect* (June 24, 2014).
- Mary Purugganan, PhD, and Jan Hewitt, PhD. "How to Read a Scientific Article," *Cain Project in Engineering and Professional Communication*, Rice University.
- "How to Read and Review a Scientific Journal Article," *Writing Studio*, Duke University.
- Robert Siegel, PhD. "Reading Scientific Papers," Stanford University.

research4life

Research papers follow the well-known IMRD format — an abstract followed by the **I**ntroduction, **M**ethods, **R**esults and **D**iscussion. They have multiple cross references and tables as well as supplementary material, such as data sets, lab protocols and gene sequences. All those characteristics can make them dense and complex. Being able to effectively understanding them is a matter of practice.

Reading a scientific paper should not be done in a linear way (from beginning to end); instead, it should be done strategically and with a critical mindset, questioning your understanding and the findings. Sometimes you will have to go backwards and forwards, take notes and have multiples tabs opened in your browser.

Resources

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3687192/
http://www.owlnet.rice.edu/~cainproj/courses/HowToReadSciArticle.pdf

General Resources

This glossary provides lay language definitions for frequently used health research terms.
http://www.cihr-irsc.gc.ca/e/documents/cihr_jargon_buster-en.pdf

The National Collaborating Centre for Methods and Tools (NCCMT) is one of six National Collaborating Centres for Public Health in Canada. The NCCMT provides leadership and expertise in evidence-informed decision making to Canadian public health organizations. These videos are an engaging way to learn about key concepts related to evidence-informed public health.
http://www.nccmt.ca/resources/multimedia

Research4Life Training Portal**:** A platform with free downloadable resources for researchers. The Authorship Skills section contains 10 modules, including how to read and write scientific papers, intellectual property and web bibliography along with hands-on activity workbooks.
http://www.research4life.org/training/