How to Conduct Scientific Research

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What Is Research?

Research

Research is a process that involves identifying problems or unmet needs, making hypothesis, using methods in one or more disciplines to test the hypothesis, summarize the observation to understand the subject and documentation. In different disciplines, different tools are required. For example, in chemical science, chemical reagents and tubes are needed. In medical science, animals or humans are involved. In computer science, workstation and servers are essential. However, all disciplines follow the same process when it comes to research.

Academic and Industrial Research

Based on the location that the research work was conducted, research can have two categories, academic research and industrial research. Both kinds of research play a vital role in promoting science and technology.

Academic research usually happens in the University or a research institute and requires financial supports from various resources like government and industries. The nature of academic research work is more exploratory (and riskier), and it takes a relatively long time to reach certain achievements. Their deliverables are usually in the form of conference presentations, research papers and patents. Only a very small portion of the research work can be commercialized.

Industrial research usually happens in the company. The company uses their own revenue for research and development. Sometimes the company also works closely with government and investors for financial supports. Industrial researchers need to convert their knowledge and research results to new products or improved productivity that helps the company make profit. Patents, publications, and internal investigation reports are becoming more and more important nowadays, especially for technology companies. Most of the industrial research projects have a relatively short turnaround time to catch up with the fast changes of the market, but sometimes it could also be lengthy (e.g., new drug development and clinical trials).

Research Starts from Reading

The first step of doing research is to formulate the research questions and make a hypothesis. Unlike high school or undergraduate study, researchers will usually not be given detailed instructions on what the specific problem is or how to solve it. Therefore, researchers need to collect background information from many different resources to clearly define the problem or propose a good solution. Literature review, which refers to a comprehensive survey of previously published research works, is the most crucial way to gather useful background information for researchers. Through literature review, researchers will develop a comprehensive understanding in the whole research area, which includes but is not limited to, the origins and definition of the topic, the major questions, problems, or the debates, the key theories, concepts and opinions, and the key sources. Meanwhile, researchers will know what theories and methodologies other researchers have used to solve similar problems and understand how these knowledge and experiences can help overcome current problems. Furthermore, researchers can prevent themselves from repeating the work that has been done by other people, which saves both time and resources. Lastly, literature reviews provide different opinions on the same scientific question. Researchers will benefit from the exchange of opinions.

For example, graphene provides superior electronic properties and physical strength that make it a promising material for electronic devices. Through literature searches, researchers should be able to know everything about graphene, from its fundamental structure and properties to its emerging applications. Researchers will also be educated on the directions and perspectives of the graphene research. A perspective article published in the

prestigious journal ACS Nano in 2020 described a research work on improving the performance of cells by adding bird drops to the graphene (Figure 1).

Will Any Crap We Put into Graphene Increase Its Electrocatalytic Effect?

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Figure 1 Researchers added bird drops into graphene to improve the performance of fuel cells. They wanted to make a point that "meaningless of the never-ending co-doping of graphene" doesn't help in the advanced of technology. [1]

It tried to convey the opinion that instead of focusing on improving the electrocatalytic properties of graphene by adding foreign materials, researchers should put more effort in understanding the fundamentals of graphene's electrocatalytic abilities and improve it by other different means.

Scientific Publications and the Peer Review Process

A scientific publication reports original experimental and theoretical work done by one or more researchers. It can also describe existing research or comment on the trends in a specific area. But before publication, the documentation of scientific work needs to be reviewed by two or more researchers in the same field—this is called the peer review process. It is the reviewers' responsibility to raise questions on the work and point out its limitations. The authors should address all questions and challenges raised during the peer review process. This process is critical to ensure the scientific content meets the journal's standards of quality and scientific validity. The work will be published only when all reviewers and editors give their approval to publish the work.

Finding Scientific Publications

1. Choose your search engine

A good search engine is key to finding high-quality peer-reviewed research work. There are many search engines available for users' consideration. Some of the free search engines includes Google Scholar, PubMed, and Core. Some other well-known search engines like Web of Science and Scopus require a subscription. Both free and paid search engines provide informative search results for users. However, it is still important to understand the differences among these search engines.

Web of Science and Scopus are widely used in the top universities and research institutes. The search results are from large human-curated databases, which is similar to a library catalog. The databases rely on a set of source selection criteria for document inclusion. Articles are entered manually, usually by expert editors, into database in a uniform way (including information on the authors involved, the title of the research article, name of the journal, the year the article was published, the volume of the journal and the page number of the article as it appears in that volume of the journal) and properly assigned to different categories (journals, conference proceedings, and books etc.). As a result, researchers can choose to search not only in the topic field but also by author, their affiliations, publication name and many other fields. Furthermore, users can narrow the search results by using the "refine results" functions to sort out documentations based on research areas, authors, publication years, organization and funding agencies. Its ready-to-use analytics reports allow users to identify major researchers, funding agencies and

journals in the specific research field. It helps keep beginners on the right tracks of literature search and gives them a big picture on current research environment. Figure 2 demonstrates several features of "Web of Science" discussed above.

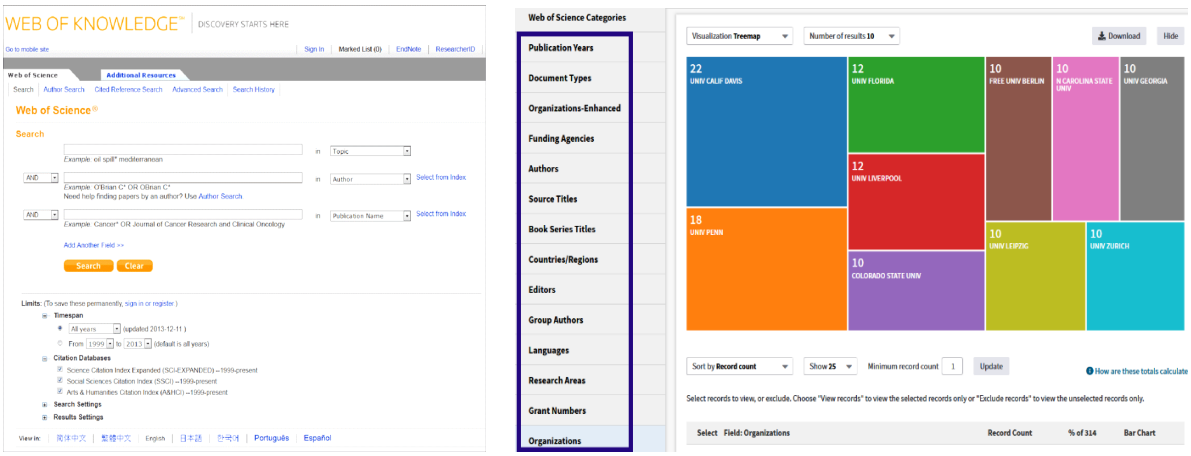

Figure 1: *A demonstration of features of paid search engine "Web of Science". The picture on the left shows the user's interface. The picture on the right shows the categories that users can used for information analysis (blue box) and visual analytical report generated by the "Web of Science". [2, 3]*

Meanwhile, the paid search engines have access to all the scientific journals or books that were indexed in their database. Therefore, it is unlikely to miss any important progress published in these scientific journals. And since the resources are exclusively peer reviewed, it avoids providing unwarranted claims, unacceptable interpretations or biased personal views that can be found in pre-print versions of research work or popular science resources.

Google Scholar (Figure 3) is different from Web of Science and Scopus because it uses an inclusive and automated search engine of the whole internet. Therefore, the search results may sometimes not be well organized and include some non-peer reviewed documentations like pre-print versions of research work, application note of a technology company and undergraduate/grad student thesis.

Meanwhile, the search results of Google Scholar could change overtime depending on whether the publishers are willing to grant Google Scholar the access to their electronic records. If the publisher elects not to share their information publicly, the information will not be updated in the search result.

2. Keyword search

Typing a question or a sentence into an academic database or search engine will not help users find the right information. Understanding how to use keywords is critical for information search. Keywords are words, phrases or terms most relevant to the focus of research work and commonly used to describe certain research topics. Usually, when submitting their work to a journal, researchers will need to choose several keywords that represent the main concepts of the research work and can be easily recognized by researchers of the same research fields. (An example of keywords could be found in Figure 7.) Researchers should be familiar with the keywords in their research field.

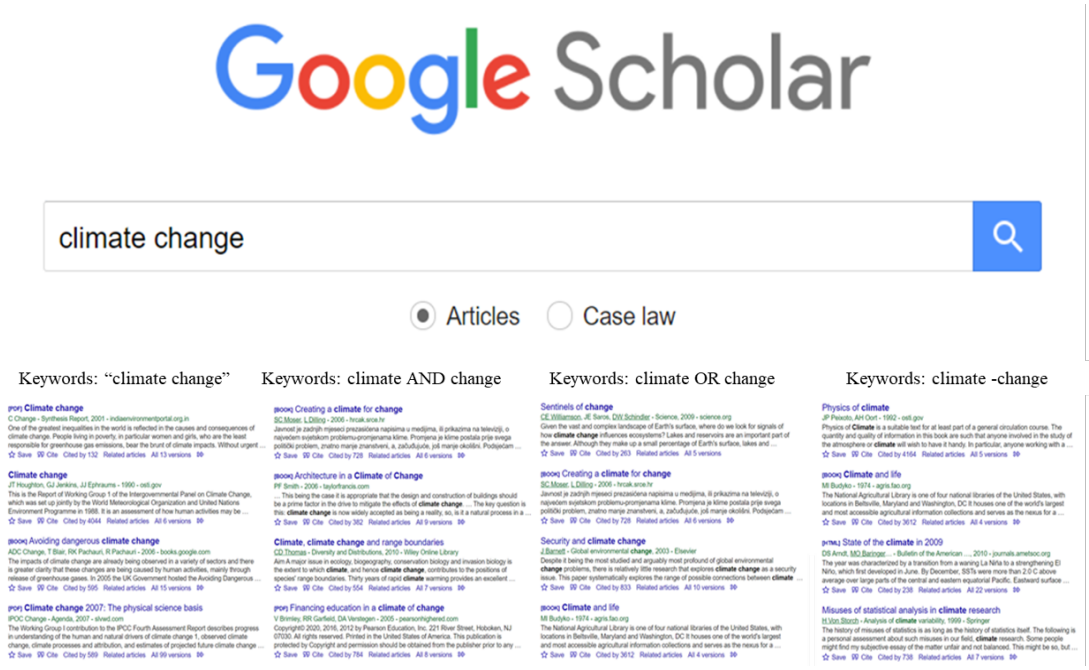

Figure 2: *User's interface of Google Scholar (top) and the search results of climate change with different operators (bottom). [4]*

Using search operators, like AND, OR, " ", and - (which means NOT), in the keyword search can further improve the quality of search results in both paid and free search engines. For example, when users search for publications related to climate change, simply entering climate change in the search bar may help them find some relevant results. However, users may also notice that the search results will include something that is irrelevant to climate change. To refine the search result, operators should be used. The use of quotation marks " " lets the search engine know that users are looking for the extract phrase "climate change" so any search results that are related to climate or change alone should not show up. When users consider climate and change as two independent keywords, the operators like AND and OR are usually used. When AND is used, every search result should include both climate and change but these two words are not necessarily next to each other. When OR is used, the search results will include at least one word, either climate or change. If the user is only interested in climate but not change, the operator "–" should be used in front of the change so the search engine will find topics related to climate but filter out all results related to change. An example of applying operators in keyword search was shown in Figure 3.

3. Access to the publication

After identifying the right articles and book chapters from the search engine, researchers will be redirected to the publisher's website to download the content. Currently, most of the journal articles, proceedings and books are not free to download. Renting/purchasing of a single article or subscription of the whole journal is usually required before researchers are granted access to the content. The subscription fee is generally high so researchers from teaching Universities/colleges, small research institutes or low-income countries will have limited access to these scientific resources. A relatively small groups of publishers provide open access service which allows researchers to download publications free of charge and use these articles fully in the digital environment.[5] Sometimes, readers may also find literatures free for download from research repository sites like Research Gate, university libraries and researchers' websites. Currently, efforts have been made to allow researchers to have access to more scientific resources. For example, in the US, the National Institutes of Health (NIH) Public Access Policy, drafted in 2004 and mandated in 2008, required all the research work funded by the NIH to have their results available to the public

through PubMed Central within 12 months of publication. In 2019, University of California boycotted one of the leading publishing companies in the world, Elsevier, over journal costs and open access.[6] In 2020, University of North Carolina elected not to renew the bundled package of approximately 2,000 e-journal titles from Elsevier, citing "the cost ($2.6 million/year) is unaffordable and unsustainable". [7] Meanwhile, the University also encourages the scholarly community to take actions that help make access to research "more sustainable, affordable, transparent and open".

4. Define the research questions and focus

Distilling the thought and defining a specific research question is the first and most important task for researchers. Once the question was defined, researchers can start to answer it. However, for most beginners, it is challenging for them to identify a potential scientific problem or generate an innovative research idea to tackle the problem due to their constrains in knowledge and research experience (Figure 4). An easier way to get through these difficult times is volunteering to help colleagues in a lab and observe what they are doing. A beginner can always help with simpler tasks like washing beakers, preparing chemical standards, and organizing samples. While working on such tasks, a beginner should always stay curious by asking their colleagues what they are doing and the rationale behind the experiment. By doing so, a beginner can quickly become familiar with the lab activity and start to get involved in the scientific discussion. Another way to start the research is to discuss ideas with principal investigators. A principal investigator is an expert in their research field, who is usually a professor in the University or a research scientist in a research and development organization. They can give their perspectives on certain research topics and provide clear guidance for the beginner.

Occasionally, a principal investigator will have some ideas in their mind and want someone's help to try it out, or need someone to complete an unfinished research project left from a previous lab member. Both cases will help the beginner get involved in research quickly.

Figure 4: *Sometimes it is difficult for beginners to come up an innovative research idea due to their constrain in knowledge and experience. [8]*

While defining the research topic and looking for ideas, it is also important to consider the resources available in the research group. Nowadays, many research work is cross-disciplinary, which makes it difficult for researchers from the same group to master all skills required for a research project. Hence collaboration becomes a key element to the success of a research project. Meanwhile, the cost of consumables should also be taken into consideration. Some biological products, like monoclonal antibody, are very expensive and researchers need to have an estimation on how much they will need to use and whether the research grant will be able to support them to finish the research work. Additionally, the cost of purchasing or sometimes maintaining analytical instruments become formidable for an individual lab. Researchers will need to actively look for analytical platforms that are available in other research institutes or contract labs.

Conducting Experiments

Once the research question is defined and a rough idea is generated to tackle the problem, researchers can start their experiment. A typical experimental process include formulating a hypothesis, designing an experiment to test the hypothesis, collecting and analyzing data and drawing conclusions. After the literature review process, researchers should have a clear idea as to how many methods can be used to achieve the goal and they can choose one to start the experiment. It is worth noting that for beginners, it will be difficult, or sometimes impossible, to determine the best approach to conduct the experiment at the very beginning.

Since the nature of research work is exploring the unknown and solving problems, it wouldn't be surprising for researchers to find that their original thought was wrong in the middle of the experiment and they have to redesign the whole experiment. Meanwhile, it is also common to identify new problems or topics while testing current hypothesis. As a result, the research process is not always straight forward, and in most of the scenarios, even for an experienced researcher, it is circular. (Figure 5).

For beginners, instead of making a static plan and focusing on the implementation, it is more important to monitor the progress and validate the hypothesis in each step. This requires beginners to be curious about the science but stay neutral about the hypothesis and experiment results. It is important for beginners to understand that when the findings do not support the hypothesis, the experiment is not a failure. In such scenarios, researchers need to record the data in a objective manner, do another literature review and formulate a new hypothesis. If researchers cannot stay neutral on their original hypothesis, it will be difficult for them to reject the hypothesis. They will become defensive on their hypothesis and waste more time to prove it is correct. The worst senario would be that data manipulation and falsification are used to achieve the desired conclusion.

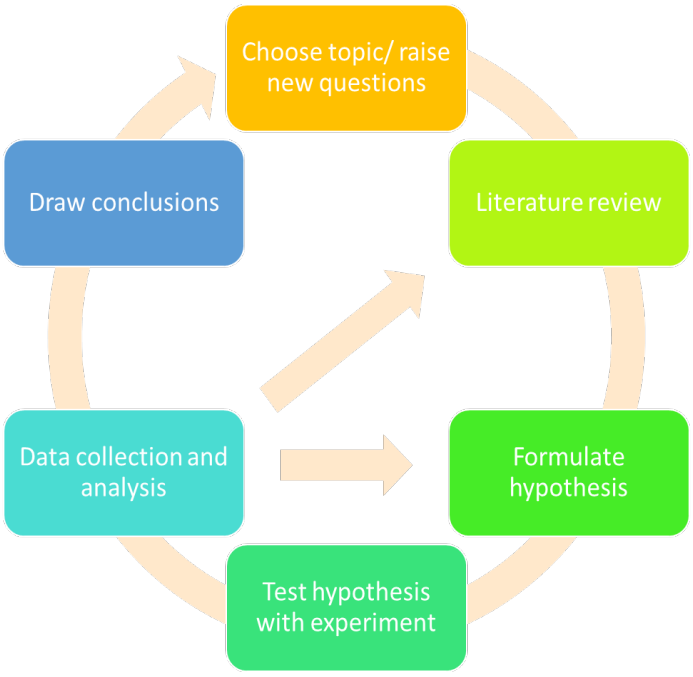

Figure 3: *The steps of conducting experiments.*

Document Discoveries

After finishing the experiment and reaching conclusions, researchers need to write down their discoveries and make them publicly available. As suggested in the previous section, scientific publication allows researchers to share their opinions and progress with other people and help the research community in advancing the science and technology. It is also the most important way for researchers to have their personal contributions recognized by the world and increases their influence. Below are a few steps that a beginner can follow to document their discoveries:[9]

1. Review generated data and identify key discoveries and accomplishments

Before writing, researchers need to understand the key discoveries or accomplishments achieved in their research work. Researchers can describe their achievement in one sentence or a short paragraph. Only when the achievement is well-defined and the general vision becomes clear, researchers can have a general assessment on the level of their contribution and set a tone for the whole paper.

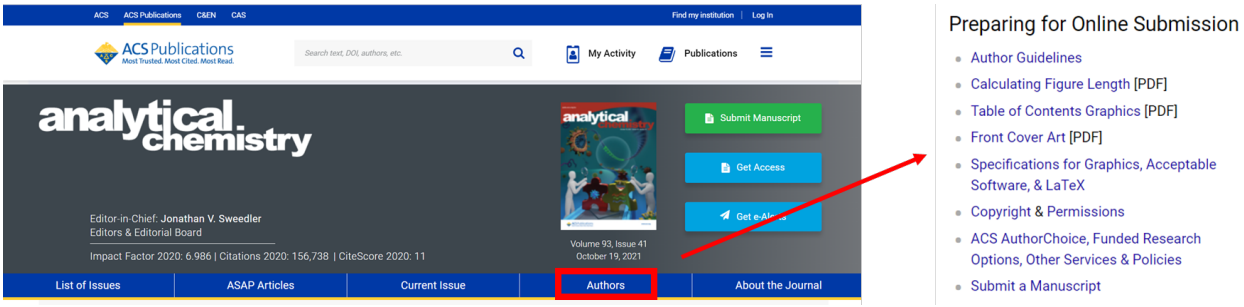

***Figure 4**: A example of finding author's guidance from a scientific journal.[10]*

Meanwhile, it helps researchers to get a general idea as to which journal the paper should be submitted to. Once a journal is chosen, researchers can check the website for requirements with regards to article type, length limit, and formatting.

For example, if researchers want to submit a research paper to Analytical Chemistry, a peer-reviewed scientific journal published by the American Chemical Society, they will need to go to the journal website and click on “Authors” to find information that authors need to know (Figure 6). Then, in the information for the author page, the researcher will find detailed guidance on how to prepare their research paper for peer review (e.g., the length of the paper and different sections, the use of fonts in different parts of the paper, the format of figures, tables and other art works, the format of reference). Read the guidance carefully to ensure that the submitted paper complies with the requirements.

2. Start drafting the article

Although journals have different requirements like formatting and length, they also share many similarities. A scientific paper usually begins with the title, abstract and keywords. The title tells readers broadly what the paper is about which will help them decide whether to read the rest of the content. Therefore, researchers should do their best to make sure the title conveys the main topic of the research, highlights the significance of work while keeping it attractive, precise, and concise.

The abstract is usually composed of 200 to 300 words. It should be able to stand alone because many times busy readers just read the abstract to understand the work. The abstract usually begins with a short statement of the purpose of the study, followed by a brief description of methods used to solve the scientific problem and major results achieved in this research work. In the title and abstract, the use of abbreviations or jargon should be avoided.

Keywords are used to index the research paper in the search engine and ensure the research work gets more attention and citations. The keywords should represent the content of the whole manuscript and be specific to the research topic. To determine the keywords, researchers can start by looking for the most important nouns in the research topic and highlights of current work.

Linking internal and external transformation for sustainability and climate action: Towards a new research and policy agenda

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Values
Worldviews
Paradigms

ABSTRACT

Climate change is an increasing threat to sustainable development worldwide. However, the dominant incremental policy approaches have not generated action at anywhere near the rate, scale or depth that is needed. This is largely due to the fact that climate change has historically been framed as a purely external, technical challenge. There is an urgent need for a more integral understanding that links internal and external (collective and systems) approaches to support transformation. However, related knowledge is scarce and fragmented across disciplines. This study addresses this gap. Through a systematic literature review, we analyse how the linkages between internal and external change are portrayed and understood in current research. We assess the scope, perspectives and approaches used to understand why, and how, internal change relates to climate action and sustainability. Our results highlight patterns and gaps regarding foci, conceptualisation, methods, epistemology, ontology and ethics that hamper emergent solutions and progress. Starting from the status quo, we propose an integrated model of change as an agenda and roadmap for future research, policy and practice.

Figure 5: *A example of an article's title, abstract and keywords [11]*

In the main body, there are usually four major sections: introduction, material and method, results and discussion, and conclusion. Beginners are encouraged to start with the material and method section because this section describes how the problem was solved and it is basically a summary of what researchers have done in this specific project. Researchers need to provide detailed information to make sure the experiment results can be reproduced by knowledgeable readers. For example, if a chemical is used, researchers need to provide the chemical name, purity/chemical grade, vendor's name and its location. Any instrument used in the study needs to have its product name, serial number, accessories, experimental parameters, manufacturer's name and its location. Also, researchers should not use unspecific descriptions like "low temperature" or "high speed". Quantitative data like "140 °C" and "1000 revolutions per minute" is required to make sure experiments can be repeated by readers. If a new method is proposed in the current study, details should be provided to prevent any potential ambiguity. If the method has been developed by other researchers and clearly described elsewhere, researchers can just generally describe the method and cite the publication where details are available.

The second step is finishing the results and discussion section. When constructing the results part, researchers want to show the most representative data to demonstrate the advantages of their work. In many scenarios, the results could be demonstrated in figures or tables which is easy for readers to understand. The purpose of discussion is to help readers understand the meanings and significance of results. Detailed explanation in the rationale behind experiment design allows readers to follow researcher's thought and accept new concepts easily. To understand the significance of the results, researchers usually need to look at data generated in previous studies and compare it with current work. If the results from current work are superior, the advantages are obvious. If results in current work is not better than previous studies, researchers need to demonstrate the novelty or significance of the work from a

different angle. For example, researchers can ask themselves whether the method proposed in this study was easier to execute and more environmentally friendly, or whether the cost of experiment was reduced. If discrepancy is observed between current results and previous work, then researchers need to find evidence from other research work to explain the differences observed or prove previous work is inaccurate. Sometimes, researchers will find that their results were wrong due to flaws in their experiment design or data collection. Then they need to go back to the lab, redesign the experiment, and collect new data.

After thorough discussion, researchers can work on the conclusion. The conclusion usually has the length of one paragraph. Since researchers have been working on the main body for a significant amount of time, it should be easy for them to distill the information and shine a light on their study. A common mistake that beginners could make is that they repeat the abstract or simply list all the important results in the conclusion section but fail to summarize them and highlight the advantages of the work.

A compelling introduction is critical for a research paper. It provides researchers an opportunity to explain the rationales of current research, including what problem is to be solved, what the current solutions are and their limitations, and what researchers want to achieve in the study. Although it is very important, it is usually the last step in writing a research paper. There are two reasons: 1) for beginners, they do not necessarily have a clear picture of what information they are trying to deliver and what the highlights in their work are. If they write an introduction first, its content may not be aligned with the results and discussion which usually requires rework. 2) the introduction sections require a comprehensive literature review and researchers will need to spend a lot of time looking for these materials. However, when describing the experiment and discussing the results, researchers only need to focus on a small area. A lot of reference materials are usually available for experiment and result in discussion because they have been accumulated during the literature review and experiment process.

After finishing the main body of paper, researchers also need to work on acknowledgement and references. In the acknowledgement section, researchers can express gratitude to people who offered help during the experiment and writing process. Although their contribution is insufficient to justify the authorship, their contribution should be recognized. Also, it is a common practice to put funding agencies (and grant number) in the acknowledgement section.

Lastly, researchers need to add references to the end of their research document. In the main text, researchers must cite all the previous publications which serves as foundation of their work. However, it is impractical to keep details (e.g., authors, titles, journal name, publish year) in the main text because it will over-inflate the manuscript. Researchers are required to study the required referencing style provided by the journal and format their references accordingly. For example, if researchers want to submit their work to the American Society of Chemistry, the reference should follow a specific format like “Foster, J. C.; Varlas, S.; Couturaud, B.; Coe, J.; O’Reilly, R. K. Getting into Shape: Reflections on a New Generation of Cylindrical Nanostructures’ Self-Assembly Using Polymer Building Block. J. Am. Chem. Soc. 2019, 141 (7), 2742−2753. DOI: 10.1021/jacs.8b08648”. For more information, authors need to check ACS Style Quick Guide. [12]

3. Submit research paper for peer review and publication

Once the manuscript is constructed and the content is agreed by all the authors, it is ready for submission. The researcher can register an account on the journal website, fill all required information, then upload the documents for assessment. The journal will examine the paper’s composition and arrangement to make sure it complies with the author’s guideline. Then, the paper will be passed to the Editor in Chief for a preliminary evaluation. If the Editor in Chief believes the scientific merit and impact of the work does not meet the expectation of the journal, the paper will be rejected immediately.

Otherwise, the paper will be assigned to an Associate Editor and the Associate Editor will send the manuscript to 2-5 reviewers and seek their feedbacks. The reviewers, usually composed of professionals in different fields (e.g., doctors in the hospital, scholars in the academic institutes and researchers from industrial Research and Development department), need to be very familiar with the research topic presented in the paper. Reviewers will study the paper carefully, identify major problems in the research work, build a point-to-point review comment, and provide the Associate Editor with a final assessment (accept, major/minor revision, or rejection). The Associate Editor will consider all the comments from the reviewers and make an overall decision. If the reviewers' opinions differ widely, the editor can get another opinion by inviting one or more extra reviewers.

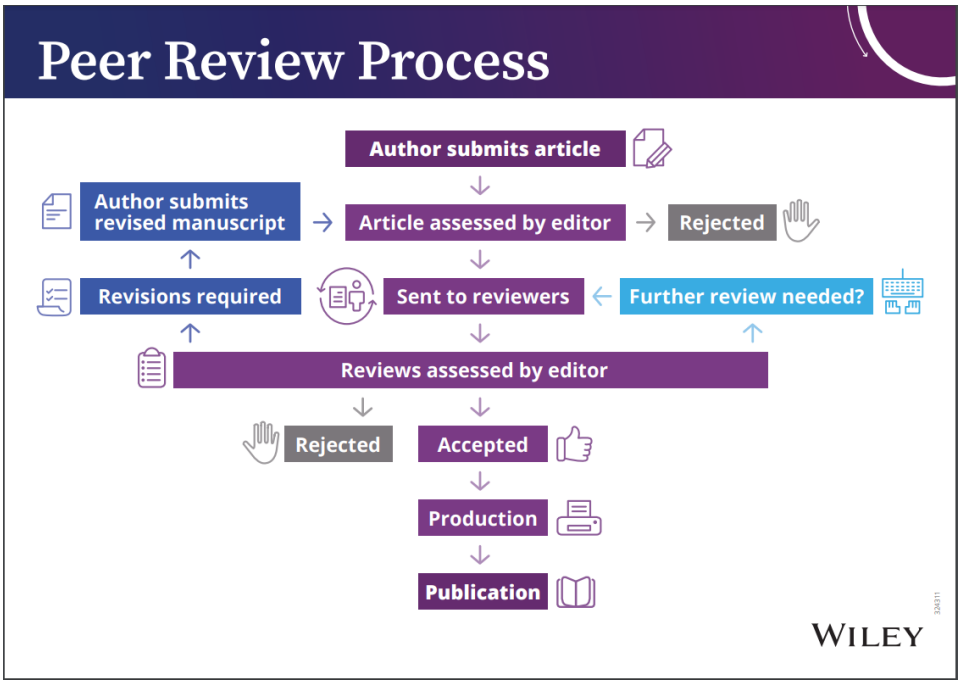

***Figure 6**: A example of peer review process [13]*

Once the decision is made, the Associate Editor will inform the authors. Rarely the paper is accepted as it is and sent directly to production and publication. Most of the time, the decision will be major/minor revisions or rejection. If the paper is rejected, researchers can submit it to a different journal for consideration. If revisions are required, researchers will have to read constructive comments from reviewers and address them to improve the quality of the paper. Depending on whether the researchers will need to conduct experiments to meet the expectation of the reviewer, the revision process can vary from a few weeks to several months. The researchers will have to submit revised documents to the Associate Editor, and then documents go back to the reviewers for a second evaluation. The reviewing process may be repeated several times until all reviewers are satisfied with the changes or a final decision, either accept or reject, is made by the editor.

An Educator's Guide for Using this Guide in the Classroom

1. Define the scope of study

Encourage students to find out scientific problems they are interested in and define the scope of the study.

For example, if learners are interested in fighting climate change, the educator will need to guide learners to dive deeper into this topic and help them understand and list all the causes of climate change (e.g., burning coal, oil and gas, cutting down forests, increasing livestock farming). Then the educator should let the learners choose a cause that they are passionate about the most and help them define the research question. For example, if a learner is interested in reducing the CO_2 emission from a coal power plant, the educator may further guide the learner to focus on a specific topic like how to capture the emitted CO_2 from a chimney.

2. Collect information and pinpoint the problem

The success of a literature search can help learners generate a big picture of the topic they choose to work on. For example, if the topic is to reduce the CO_2 emission from a coal power plant, learners need to figure out 1) what is the emission level of coal power plants; 2) what are current challenges on reducing the CO_2 emission in these plants; 3) what are current challenges faced in capturing CO_2; 4) what are the solutions used for CO_2 reduction/capture and the advantages and disadvantages of each solution; 5) identify the improvement opportunity of current solutions or propose a new solution for more efficient CO_2 reduction/capture; 6) search for methodology, materials and equipment required for the proposed improvement or new solution; 7) if CO_2 capture is proposed as a solution by the learners then the educator needs to follow up with questions like how to store or utilize CO_2 once it is captured. The educator can always refine or redefine the topic if it is too difficult for the learners.

3. Search the available resources and conduct experiments

Look for the tools and research platforms that is available in the same city. Many medical doctoral universities (e.g., University of Toronto, University of British Colombia) or comprehensive universities (e.g., University of Waterloo, University of Victoria) have research teams or research platforms which allow collaboration and high-quality personal training to happen. Conduct experiments based on the research proposal and modify the experiment plan when necessary.

4. Documentation

Document the findings and submit to scientific journal for peer review. If the scientific merit of the work is not high enough to be published in a peer-reviewed journal, the work may be uploaded to a preprint repository (e.g., ChemRxiv) for comments and feedback from peers.

Summary and Outlook

Starting to engage in scientific research as early as grades 11/12 or at post-secondary level will provide academic, personal, and professional benefits to learners because the research activities allow them to develop analytical and critical thinking skills. It will also prepare them for the rigors of professional lives or graduate studies.

This document provides information and general guidance on major steps in the research process, including literature review, experiment execution, and documentation. The main goal is to help educators understand the process of scientific research and provide guidance to learners. Post-secondary learners can also study this material independently. Through the research training, learners are expected to take a deep dive into a specific discipline and

learn how to make informed decision. With more effort being put in the research, learners can develop further understandings as to how to apply research concepts to solve real-world problems and discover how to work independently and function as a team member. Meanwhile, GreenLearning will always provide challenges and research event opportunities to assist our prospective researchers. Thank you for working with us and leading learners in this new endeavor.

References

[1] Lu Wang, Zdenek Sofer, and Martin Pumera, Will Any Crap We Put into Graphene Increase Its Electrocatalytic Effect? ACS Nano 2020 14 (1), 21-25;
[2] Anup Kumar Das, Open Access for Researchers, Module 4: Research Evaluation Metrics. the United Nations Educational, Scientific and Cultural Organization 2015;
[3] Veterinary - Research databases: Analyze Results and Citation Report in Web of Science. Link: https://guides.lib.lsu.edu/c.php?g=923391&p=6838312
[4] scholar.google.com;
[5] Open Access (OA) Resources Research Guide. Link:https://libguides.d.umn.edu/OA/Organizations;
[6] University of California Boycotts Publishing Giant Elsevier over Journal Costs and Open Access. Link: https://www.science.org/content/article/university-california-boycotts-publishing-giant-elsevier-over-journal-costs-and-open;
[7] Upcoming Elsevier Cancellations-A message from Provost Bob Blouin and University Librarian Elaine Westbrooks. Link: https://library.unc.edu/2020/04/upcoming-elsevier-cancellations/;
[8] Andreas Chandra, Searching A Novel Method in ML Research. Link: https://medium.com/data-folks-indonesia/searching-a-novel-method-in-ml-research-83026e8c4cc;
[9] Angel Borja, 11 Steps to Structuring a Science Paper Editors Will Take Seriously. Link: https://www.elsevier.com/connect/11-steps-to-structuring-a-science-paper-editors-will-take-seriously;
[10] Information for Authors. Link: https://pubs.acs.org/page/ancham/submission/authors.html;
[11] Christine Wamsler, Gustav Osberg, Walter Osika, Heidi Herndersson, Luis Mundaca, Linking Internal and External Transformation for Sustainability and Climate Action: Towards A New Research and Policy Agenda. Global Environmental Change. 2021 (71), 102373;
[12] ACS Style Quick Guide. Link: https://pubs.acs.org/doi/full/10.1021/acsguide.40303;
[13] Guidelines for the Preparation of Figures. Link: https://authorservices.wiley.com/asset/photos/Peer-Review-Process.pdf