# 4.1 Introduction to Journal Articles

Scene 1: Talking head

Imagine a group of researchers who are conducting a study on microplastics in drinking water. Microplastics are pieces of plastic that are less than 5mm in length and a source of pollution in our everyday drinking water. Researchers have conducted a study and now have results that they want to share with others. One of the most common ways for researchers to share their findings is by writing an article for a specific journal. But, what exactly are journal articles and why are they so important for engineering research?

Scene 2: Voice-over

*[show definition of journal]* A **journal** is a type of publication that publishes articles in a particular discipline or area of study on a regular basis. You can think of a journal like a scholarly magazine. A journal might be published once every two weeks or every month, or every two months, but no matter the frequency, it will include a collection of recent articles by different authors in the journal’s area of focus. *[show definition of journal article]* We can define a **journal article** as a report that outlines the findings of a research study published in a journal.

One of the reasons journal articles are valued is that they are often peer-reviewed. *[show definition of peer review]* **Peer review** refers to the process of having an article or other piece of writing reviewed and evaluated by other researchers or professionals knowledgeable in the field of research. Peer review provides a mechanism for people who are knowledgeable in a discipline to assess the quality and validity of the research, so that low-quality research is not published. In this way, you can think of peer review as a type of quality control for journal articles.

The group of researchers studying microplastics might submit their article to a journal that publishes research in environmental science or chemical engineering. If the journal is peer reviewed, it will be reviewed and the peer reviewers will recommend if the article should be published, revised, or rejected.

Scene 3: Talking head

Let’s return to the question of why journal articles are so important for engineering research. First, journal articles are a common way for researchers to communicate new findings, allowing us to learn about new and exciting research. Secondly, and arguably more importantly, many journal articles are peer reviewed, meaning that experts have found them to be of high quality, which provides you with an extra level of confidence.

# 4.2 Reading Journal Articles

Scene 1: Talking head

Have you ever had to read a research paper and felt overwhelmed by the amount of information being presented? Don’t worry – it's not just you. Journal articles can be challenging.

In this video, we will review the different parts of a research paper and how we can use that knowledge to become more effective and efficient when reading papers.

Scene 2: Voice-over

*[Section title: Structure of a Research Paper]*

The typical structure of a research paper can be represented by the acronym “IMRAD”. *[display IMRAD acronym and what each letter stands for]* This stands for Introduction, Methods, Results, and Discussion. Let’s look at each of these four sections of a paper in turn.

The introduction section will help you to understand why the research was done. It will outline existing knowledge in the field of research and the motivation for conducting this study. The introduction is also where you will find the research question.

The methods section provides details of how the study’s data was collected. It will include information about the samples or populations and the experimental techniques used. It should contain enough detail that another researcher could re-implement the study themselves.

The results section is where the authors present the findings generated by their research project, often using tables or figures. However, you won’t find any interpretation of the results in this section.

The interpretation of the results happens in the discussion section. This is where the authors will answer the research question and explore how the results contribute to our understanding of the topic being studied.

You may find that some articles include other common sections, such as a Conclusion. Most articles will also have an abstract, which is a short summary of the research, and is found at the beginning of the article. But the IMRAD structure is often the basis of academic journal articles. If you know what information is available in each section of a research paper, you can apply this knowledge to find what you need.

*[Section title: Three-Pass Approach]*

Scene 3: Voice-over

Understanding the structure of a research paper can be useful when using a strategy for reading a paper, such as the three-pass approach. This approach to reading a paper was developed by computer science professor Dr. Srinivasan Keshav at the University of Waterloo. You will read a paper in one, two, or three passes, depending on how well you need to understand the paper. Each pass uses different strategies and will help deepen your understanding of the work.

*[display summary of 1st pass]* In the first pass, you’ll read the title, abstract, and introduction, scan the section and sub-section headings, and read the conclusions. You’ll also glance over the list of references and note any you’ve read. This will take you about 5-10 minutes, and by the end of this you’ll have a “bird’s-eye view” or a high-level idea of what the paper is about. From here, you can decide if the paper is relevant to you and worth a second pass, or if a surface-level understanding is enough for this paper.

*[display summary of 2nd pass*] In the second pass, you’ll read through the entire paper, paying close attention to figures, diagrams, and illustrations. You’ll also identify any papers that are cited that will help you learn more about the topic. This will take about an hour, and when you’ve finished the second pass you should be able to summarize the main points of the paper. You may choose to stop after this pass, or you might continue on to a third pass.

*[display summary of 3rd pass]* In the third pass, you will attempt to virtually re-implement the paper. You will identify and challenge every assumption that the authors have made and rearticulate ideas that the authors have presented to see if you would present them the same way. By the end of the third pass, you will be better able to evaluate the paper; that is, you will be able to identify its strengths and weaknesses. For beginners, this pass can take four or five hours. That’s a lot of time! You won’t require a third pass for every paper you read, but it is important for papers in which you need to understand deeply.

To read more about the three-pass approach, see the link to read Dr. Keshav’s paper about it in the Additional Resources section of this module.

Next time you need to read a paper, consider applying the three-pass approach, and see how it changes your reading experience.

*[Section title: Summary]*

Scene 4: Talking head

Let’s review what we’ve learned *[show a short summary of this video in point form]:*

The major sections of a research paper are represented by IMRAD which represents the Introduction, Methods, Results, and Discussion. When you consider what you hope to learn from a paper, go directly to the appropriate section to find and read the information you need more quickly.

You can use a three-pass approach to guide your reading strategy – you may need only one pass to get a general understanding of a paper, two passes for a more thorough understanding that allows you to summarize a paper, and three passes for a deeper understanding that allows you to critique a paper.

 To help you put what you’ve learned into action, ask yourself: Based on what you’ve learned, how might you change your approach to reading articles?

# 4.3 Finding Journal Articles

Scene 1: Talking head

[insert hook]

If you do a search on Google for the word microplastics, there are millions of results. This can be really overwhelming. It’s important to have some strategies to help you find an appropriate amount of relevant research so you can use your time efficiently.

If you know you need to find some journal articles on your topic, how should you go about finding them?

Scene 2: Voice-over

We’ll discuss three approaches to finding journal articles *[display list]*:

* Browsing online journals,
* Using Google Scholar, and
* Using a library database

*[Section title: Browsing online journals]*

Scene 3: Voice-over

[optional: record videos for demos by sharing computer screen]

One way to look for journal articles is to browse through some relevant journals. If you know the title of a journal that’s relevant to your research topic, you can access that journal through your library’s website and browse through recent issues of the journal to see what is being published.

*[Demo the following search]* You can go to the McMaster Library website and click on the Online Journals tab to search by the name of a journal. I’ll search for the journal *International Journal of Plastics Technology.* Here I see some different options to access this journal, with notes about what years and volumes of the journal are available for each option. The first option, E-Journals – Scholars Portal, doesn’t include any access after 2016, so I’ll click on the second link which will include more current content. Now I can browse and view some recent articles from this journal.

This strategy for accessing journal articles works well if you know a few journals related to the area of research you are conducting and want to see what researchers are working on and writing about. If you need to find a few different articles on a specific topic for an assignment, this is not the most efficient way to do that, so you’ll want to consider one or both of the following options for finding articles.

*[Section title: Finding articles with Google Scholar]*

Another popular strategy for searching journal articles is to search with Google Scholar. Google Scholar is a web search engine that searches academic sources, as compared to Google which searches all web content. It allows you to search across disciplines and publications including journal articles, theses, books, conference proceedings, technical reports and more. You can access Google Scholar at scholar.google.com. Google Scholar is easy to use and will usually find lots of content.

*[Demo the following search]* For example, let’s look at a search for microplastics and drinking water. You can see that this search finds over 10,000 results! The odds are good that you will find some relevant articles in this result list, but there are likely irrelevant articles too.

*[Show how to add library links]* You can configure your settings so that you’ll see links in your search results to get the full text from the library if it’s available. To add links to full text from McMaster Libraries, open the menu and go to Settings. Now you can click on Library Links and then search for McMaster, select the checkbox, and click save. Now full text options from the library will appear to the right of your search results.

*[Section title: Finding articles with library databases]*

Google Scholar can be helpful, but it doesn’t focus on any particular disciplines, and its search options are quite limited. It’s great for simple searches and when you are getting started with your research, but to do some more in-depth searching, you’ll want to use a library database.

A library database is a searchable collection of published information from many different sources. With a library database, you can search for articles across a large number of journals simultaneously. Some library databases focus on certain subjects or disciplines, so you can find databases that focus on areas like engineering, or computer science, or chemistry. Others are broader and will include journals from a wide variety of disciplines, but it will have search features that allow you to be very precise in searching for articles on your topic.

*[Demo finding a library database for Chem Eng]* To find a library database at McMaster, go to the library website and click on the Databases tab. Here you can search for a database if you know it’s title, or you can browse for databases by subject. If I use the menu to look up databases in Chemical Engineering, I am brought to a list of 18 relevant databases, including some “Best Bets” or recommended databases for this subject.

Scene 4: Talking head

Now you know three different ways to search for journal articles including browsing in online journals, searching with Google Scholar, and finding a relevant library database. These strategies will help streamline your research process. We’ll look more at searching with library databases in the next video.

# 4.4 Building a Search Strategy

Scene 1: Voiceover

Before searching in a database, you’ll want to develop your search strategy. [show definition of search strategy] A **search strategy** is a combination of search terms used to search in a database. The words you use in your search strategy and the way that you combine them will determine how many results you find and if they are relevant to your topic. Here is a three-step process you can use to turn your research topic into a search strategy. *[display this list]*

1. Identify the main concepts in your research topic.
2. For each concept, list potential search terms, including synonyms and broader or narrower terms.
3. Combine search terms with Boolean operators.

We’ll look at each of these steps in more detail using an example. Let’s imagine that you already have a research topic. You want to research the presence of microplastics in drinking water.

Scene 2: Voiceover

*[use lightboard to show development of search strategy]* First, we identify the main concepts in the research topic. Main concepts refer to the important ideas in your topic and they are usually nouns; that is, people, places, things, or ideas. In this example, the main concepts are **microplastics** and **drinking water**.

In the next step, you’ll want to create a list of search terms for each major concept. The search terms should include synonyms and other words that could be used to describe that main concept. For the main concept of **drinking water**, an alternate term might be **tap water**. For the concept of **microplastics**, an alternate term might be **nanoplastics**.

In the third step of creating a search strategy, we combine our search terms with Boolean operators. Boolean operators are the words used to connect your search terms and tell the database what the relationship between these terms is. The three operators commonly recognized by library databases are AND, OR, and NOT. When two search terms are combined with AND, the database will retrieve results that include both terms. When two search terms are combined with OR, the database will retrieve results that include either term, or both terms. And when a search is done for Term1 NOT Term2, the database will retrieve results that include Term1 but not Term2. The two Boolean operators you will use most often are AND and OR.

Scene 3: Voiceover

In our example we have come up with a list of four search terms. **Drinking water, tap water, microplastics,** and **nanoplastics.**

We can combine search terms that are related to one main concept with OR, so that we find articles that include any of these search terms. We would search for **drinking water OR tap water**. Similarly, we would search for **microplastics OR nanoplastics**.

We combine major concepts with AND. We will want to find articles that have a search term related to drinking water or tap water, and a search term related to microplastics or nanoplastics. Our search strategy for this research topic would be: **(drinking water or tap water) and (microplastics or nanoplastics)**, where brackets are used to tell the database what order to read the Boolean operators in. This search strategy is ready to bring to a database. Once we enter it into a database, we can look at the results and decide how effective the search strategy is for finding articles on the research topic. From here, we can decide if we need to modify our search by adding or changing terms.

Creating a search strategy is a process, and sometimes it takes more than one try, and that is okay! Now you’re ready to start creating search strategies on your own, and you’ll find that as you practice this skill, it will become easier and easier to do.

# 4.5 Searching in Engineering Village

Scene 1: Talking head

In this video, we’ll talk about searching for articles with Engineering Village. What is Engineering Village? It’s a platform for searching a few engineering databases. Different libraries subscribe to different databases through Engineering Village.

Scene 2: Voice-over (+ sharing screens for demos)

 The two databases in Engineering Village that we will focus on are Compendex and Inspec. Compendex allows you to search a broad range of engineering literature across 190 engineering disciplines. Inspec is a database that covers research in fields that include physics, electrical engineering and electronics, computers and control, mechanical, production engineering, and information technology. Searching both Compendex and Inspec in Engineering Village is a great place to start when looking for engineering journal articles and other literature such as conference proceedings, books, and dissertations.

*[demo1]* At McMaster, you can access Engineering Village by going to the library website at library.mcmaster.ca. In the main search box, click on the Databases tab and search for Engineering Village. Click on the link to Engineering Village and login with your MacID and password.

*[demo2]* The search box in Engineering Village is found in this green rectangle near the top of the page. Below it we can see some options to limit our search by database, date, language, and so on. Below these options, we can choose which Engineering Village databases we’d like to search in. We’ll search in all of the databases we have access to, in this case Compendex, Inspec, GEOBASE, and GeoRef.

*[demo3]* Let’s use the example of looking for articles about microplastics and drinking water. We can type in our search strategy here **(drinking water or tap water) and (microplastics or nanoplastics)**. You can use this drop-down menu to choose which fields you’d like to search in, such as abstract, author, or title fields. For this search, we’ll use the default option to search in all fields. Click the magnifying glass to search.

*[demo4]* This search finds over 200 records. We can see information about the articles and other publications that have been found on our topic. To the left of the search results, we can see some options to refine our search results by different filters like document type, database, year, or language. Let’s limit this search to only look at journal articles. You can see this has reduced the number of search results by removing some other types of publications.

*[demo5]* For each result shown, you can see the title, authors, source, database, and document type. You can click on the title of a result to see more information, including an abstract. If you want to access the full text, look for the “Full text” button or the “get it!” button to access the full-text through the library.

*[demo6]* If you want to save some results for later, Engineering Village provides some options for you to do that. First, select any results that you want to save using the checkboxes to the left of the title. Then, click on one of the three icons at the top of the search results to email, print, or download the results. Downloading is also where you would click to save the results to a citation manager such as Mendeley.

*[demo7]* If you want to return to a search you conducted earlier in your Engineering Village session, visit your Search History to view each search strategy you’ve used and the corresponding search results. If you want to explore some more advanced searching functionality, use the options in the Search menu, like the Expert search or the Author search.

Scene 3: Talking head

Throughout these videos, you have learned about the purpose of journals as well as strategies for reading and finding journal articles. While this process can be challenging, with time and practice you will become a skilled and effective researcher. These skills will be helpful to your studies and will even serve you well as you move into professional contexts. Take heed and enjoy the process!