Unit 1

Academic Reading

Throughout your university study, you'll be responsible for completing different types of assessments: pre-quizzes, essays, group projects, tests, exams, etc. Teachers assign these in order to mark your learning progress. In order to prepare for these assessments, you should study effectively.

During this process, reading comes first. When you get to university, you'll find you need to get through a lot of readings from your reading list to prepare for an assignment. These may include academic papers, or chapters in edited books or textbooks. Many of these academic texts will seem quite difficult, especially academic papers. Have you ever tried to explore the characteristics of its language or structure?

Generally speaking, an academic paper will well present a systematic way of getting data, discovering new facts, developing new theories or reaffirming the previous work and solving new or existing problems, which makes its structure unique and various because of differences in disciplines. There are also commonly acknowledged prestigious journals in different fields. Do you have a basic understanding of the top journals in your field? You can start your reading journey from the pre-class tasks.

Pre-class tasks

Ⅰ Suggested MOOC resources

You can scan the QR code to get a general idea of variations in structure of an academic paper in different fields.

- Overview of academic papers on geoscience
- Overview of academic papers on civil engineering
- Overview of academic papers on electrical engineering
- Overview of academic papers on metallurgical engineering
- Overview of intensive reading of academic papers on chemistry

Ⅱ Pre-quizzes

1. **What is the most commonly used structure in academic papers?**

A. RMID. B. IMRD. C. IRDM. D. ILMRD.

2. **Which of the following methods is NOT involved in research on civil engineering?**

A. Theoretical method. B. Experimental method.

C. Instrumental method. D. Numerical method.

3. **Generally speaking, how many types of papers are there in the electrical engineering field?**

A. Four. B. Three. C. Five. D. Two.

4. **Which of the following statements is NOT true about the grammatical features of academic papers?**

A. There are a lot of declarative sentences for the scientific facts.

B. There are many long and difficult sentences for discussion on authors' viewpoints.

C. There are numerous active voices for objectivity.

D. There are lots of nonfinite verbs making analyses more scientific and precise, such as gerund and prepositional phrases.

5. What information can we NOT infer from the title "Increasing Stability and Activity of Core-shell Catalysts by Preferential Segregation of Oxide on Edges and Vertexes: Oxygen Reduction on Ti-Au@Pt/C"?

A. Research method. B. Research goal.

C. Research question. D. Research target.

In-class tasks

1.1 General glimpse of academic reading

Academic reading is the most essential step for academic learning. As a college student, you may be assigned numerous reading tasks on various topics, from impacts of the greenhouse effect on global warming to countermeasures for natural disasters like volcanic catastrophe during your academic learning, which are more challenging compared with those tasks in general reading. In addition, academic reading materials are mostly of various types and unique features.

1.1.1 Different types of academic reading materials

Depending on your subject, you may be reading journal articles, reports, case studies and books. Generally speaking, what you read extensively or intensively during your academic journey can be called as scientific literature, which comprises scholarly publications that report original, empirical or theoretical work in natural and social sciences, and within an academic field.

1.1.2 Classification based on the form

Scientific literature can be classified into the following types based on its form: journals, monographs, conference proceedings, graduation papers or dissertations; technical reports, science news, patents, product specifications, governmental publications and standards, etc.

Here we choose three types to illustrate in detail.

1.1.2.1 Journals

A scientific journal is a periodical publication intended to further the progress of science, usually by reporting new research. The research article is one of its types. The research article usually:

- Gives a full report on new research conducted by the authors;
- Contains abstract, introduction, methods, results, discussion, and conclusion;
- Gives detail for others to evaluate the findings or repeat the experiment;
- Cites other researches.

And the letter/note is another type, which:

- Reports a significant research result that does not require an extensive study;
- Is a brief article, typically within 2–4 pages;
- Is not divided into sections;
- Has citations within.

The third type is review article, which usually:

- Reviews several previously published works on one topic;
- Reports on work done by many scientists;
- Has citations within.

1.1.2.2 Conference proceedings

Conference proceedings usually reveal the latest discoveries, results, achievements, and developing tendencies in the field concerned. They are reports of presentations made at professional meetings and may be the whole articles or just abstracts of the presentations.

1.1.2.3 Patents

A patent is an exclusive right granted for protecting an invention, which describes a new invention and provides legal rights for the inventor.

1.1.3 Classification based on the processing depth of the research sources

Scientific literature can also be divided into the following three types based on the processing depth of the research sources.

1.1.3.1 Primary literature

In the field of sciences, the primary literature presents the immediate results of research activities. It often includes analyses of data collected in the field or laboratory, and presents original research and/or new scientific discoveries.

Here are some examples: original research published in peer-reviewed journals, dissertations, technical reports, and conference proceedings.

1.1.3.2 Secondary literature

The secondary literature summarizes and synthesizes primary literature, and it is usually broader and less current than primary literature. It includes literature review articles and books. Most information sources in the secondary literature contain extensive bibliographies, and they can be useful for finding more information on a topic.

1.1.3.3 Tertiary literature

The tertiary literature presents summaries or condensed versions of materials, usually with reference to primary or secondary sources. They are a good place to look up facts or get a general overview of a subject. Textbooks, dictionaries, encyclopedias and handbooks are typical examples.

1.1.4 Features of academic reading

1.1.4.1 More new or technical words

Many textbooks and journal articles are written in formal academic language, and subject-specific jargon will be used too. The following is an example—one paragraph of an academic paper from *Applied Nanoscience* that you will not fully understand unless you already know or can deduce what the terms refer to:

> Diesel particulate filter (DPF) is an advanced technology adopted in diesel vehicles to control particulate matter emissions. However, particulates get accumulated in the DPF and have to be regenerated periodically to reduce the backpressure. In the present work, Ceria, which is an excellent catalyst, has been coated over the DPF as nanofibers to ensure passive regeneration at a lower temperature, which aids in the continuous regeneration without soot accumulation. The cerium oxide nanofibers were synthesized by hydrothermal synthesis and characterized. The ceria nanofibers were coated on FeCrAl alloy by dip-coating method, and the regeneration studies

> were done by thermogravimetric analysis (TGA) and CO_2 emission analysis. (Gautham et al., 2020)

At the beginning of the semester, you will have to learn the terms each new paper introduces. Help yourself by identifying words new to you and assimilating them fully into your vocabulary. In particular, learn what certain terms mean, which does require time and effort. For example, the paragraph cited above includes terms that are related to vehicle and transportation, such as "diesel particulate filter", "emissions", "backpressure", "nanofibers", "soot", and "regeneration". It may also include more specific terms such as "catalyst", "cerium oxide", "dip-coating", "thermogravimetric", "CO_2", and many other words that abound more in academic reading than everyday reading.

1.1.4.2 Complex sentences

Some textbooks or papers are definitely more user friendly. Titles, subtitles and margin notes all give helpful hints to the author's intentions, but even then, some complex sentences need to be carefully and deliberately deconstructed for the full message to be clear. For example:

> The figure shows that the efficiency curves, corrected by considering the internal heat transfer contribution, are shifted toward the measured quasi-adiabatic curves, thus proving the reliability of the proposed experimental method for the heat transfer evaluation and the correction of the measured compressor efficiency map. (Gautham et al., 2020)

1.1.4.3 Dense paragraphs

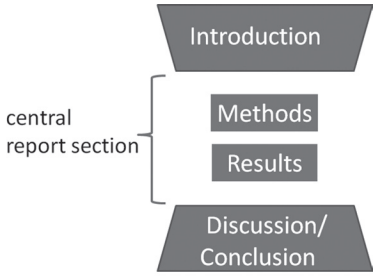
In academic reading, it is common to read dense paragraphs that make it difficult to decipher the information. At this time, knowing how paragraphs are constructed can help a reader sort out the information and decide which points are the most important.

Now that we know how unique academic reading is, how can we start our academic reading effectively? Active learning and effective reading require more engagement than just reading the words on the page. In order to learn and retain what you read, it's a good idea to do things like circling key words, skimming and scanning, and reflecting on what you are learning.

Normally, we can gather information, gain knowledge and perform academic tasks through academic reading. All these tasks require not only simple comprehension, but also a full understanding of the basic structure of academic papers and good command of reading strategies, which help you to summarize, synthesize, and critically analyze the papers.

1.2 Basic structure of academic papers

Readers in various fields ranging from mechanical engineering to chemistry will expect the same basic structure from technical reports and papers. After examining thousands of different papers, people have identified four main sections that many technical papers have in common: introduction, methods, results, and discussion. Together, these four sections are known as IMRD (See the figure below). By following a general IMRD structure, you can ensure that your audience can find the information they're looking for.



The conventional academic papers always follow the layout of IMRD, however, there are some variations among different disciplines. Sometimes academic papers on biological medicine usually follow the IRMD layout, but papers on electrical engineering include introduction, theoretical principles, simulation, and results (Scan the QR code to learn the two different layouts).

Let's review these four sections in detail.

1.2.1 Introduction

The introduction section states the problem or the question(s) you intend to address through research. It typically includes the following parts:

- Statement of the topic you are about to address;
- Current state of the field of understanding (Often, we call this a literature review);
- Problem or gap (What do we need to know? What still needs to be understood in the field? What has been left out of previous research? Is this a new issue that needs some directions?);
- Plan to solve the problem (Forecast statement that explains, very briefly, what the rest of the paper will entail, including a possible quick explanation of the type of research that needs to be conducted).

1.2.2 Methods

Regardless of what you did for your research, the methods section needs to be very clear, specific, detailed, and only focused on research itself. It typically includes the following parts:

- Set of procedures followed and approaches adopted by the researcher (How does the researcher proceed to collect the data?);
- Experimental materials or equipment (What does the researcher use to collect the data?).

1.2.3 Results

The results section is critical for your audience to understand what the research showed. Use this section to show tables, charts, graphs, quotes, etc., from your research. It typically includes the following parts:

- Findings of the study based on data collected from the methods section;
- Comparisons with what was expected or with results from other studies.

1.2.4 Discussion

The discussion section mainly focuses on authors' interpretations and opinions of the results, which serves as a bridge between current study and the previous related ones. It typically includes the following parts:

- Discussion of the key results and explanations of them;
- The limitations of your study;
- Implications and future study.

1.3 Skills for academic paper reading

Academic reading can be kind of difficult. But it may also be easy for you to find out the major points of an academic paper, because all academic papers ought to follow some fairly strict conventions in their structures. If you realize that academic papers are written in a particular style, you will understand what the author is saying. Only when you figure out the author's arguments can you make comments on the text, the content, the way the information is presented, and draw conclusions about the usefulness of the paper in general or more specifically to your research or your course. There are some basic skills to help you read dense, lengthy academic papers efficiently and effectively.

1.3.1 Consider the paper as a whole

Consider the paper as a whole. You need to determine something about the purpose, the audience and the content of the paper before you start reading. Look for clues in the title and/or subtitle, the acknowledgement (if any), the author affiliation or address, the first footnote or endnote, and the author's biographical note.

Here are some questions to guide you in considering the paper as a whole:

- Who is writing the paper? (Getting clues from the name, credentials, and affiliations)
- What are the author's qualifications? (Getting indications from information such as university or research affiliation or company)
- To whom is the author addressing? (Getting hints from the publication or journal itself and the first couple of paragraphs)
- What is the paper about? (Getting ideas from the abstract or conclusion sometimes)

1.3.2 Skim strategically to identify the main purpose and argument in the text

Before you read the text from beginning to end, skim it strategically to locate the author's main purpose and argument. Having the author's purpose and main argument in mind can help you read and interpret the rest of the text. These are sections where

you are likely to find information about the author's purpose and argument:

Abstract: The abstract is an "executive summary" that appears in academic texts, usually as a paragraph at the top. As you read the abstract, try to identify the text's purpose, the main problem it deals with or question it answers, its main findings, and why readers should care. Abstracts are densely written—do not despair if you must re-read them. It is worth researching the terms in the abstract if you do not understand them.

Introduction: This is a real gem. The introduction of an academic paper often provides clear statements about the author's purpose, the question it answers, and its main points.

Conclusion: Pay close attention here, even if you assume the conclusion might be repetitive. The author may re-phrase a key point in a way that makes it clearer to you. This may also be the only place in the paper where the author discusses unanswered questions. These questions can help prepare you for discussion or fuel a written reflection.

1.3.3 Skim for the organization or "architecture" of the paper

Before you read the text from beginning to end, skim it to get a sense of its organization or "architecture". Doing this gives you a mental map that helps you see the different parts of the paper and its function in the overall argument. This perspective can help you read and process the text more easily. Strategies for building a mental map of the article's organization include:

Introduction (again): Look for a "forecasting statement" in the introduction. In addition to telling you about the author's purpose and argument, the introduction often provides one or more statements that preview the content and structure of the paper. Such statements give you a road map that helps you interpret the rest of the paper.

Section headings: Flip through the paper to read through all the section headings. Doing so can help you see the overall structure of a paper.

As you read the body of the text, use your knowledge about the main point of the paper and context clues from your discipline as you decide which parts of the paper deserve most of your energy, and where you can skim.

1.3.4 Read the paper and pay attention to its writing

As you read, watch for what the author is saying and how it is said, which